

THIRD ANNUAL REPORT  
OF THE  
STATE  
OIL AND GAS SUPERVISOR  
OF CALIFORNIA

1917-18

BULLETIN No. 34

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BULLETIN No. 84

THIRD ANNUAL REPORT

OF THE

State Oil and Gas Supervisor  
of California

FOR THE FISCAL YEAR 1917-1918

Covering Operations of the Department of Petroleum and  
Gas of the State Mining Bureau

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Submitted to

FLETCHER HAMILTON, State Mineralogist

by

R. P. McLAUGHLIN, State Oil and Gas Supervisor

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CHIEF DEPUTY SUPERVISOR

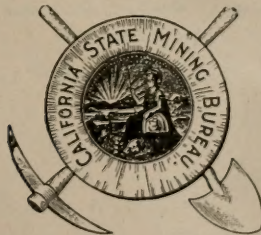
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W. W. THAYER, Secretary



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## LETTERS OF TRANSMITTAL.

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December 1, 1918.

*To His Excellency, the HONORABLE WILLIAM D. STEPHENS,  
Governor of California.*

SIR: I have the honor to transmit herewith Bulletin No. 84 of the State Mining Bureau, being the Third Annual Report of the State Oil and Gas Supervisor.

The law providing for the protection of California oil deposits against water and other damage following improper development methods is an outgrowth of local conditions, and had little or no precedent to follow.

The underlying motive is to gather and arrange facts as to underground conditions and supervise oil field operations, as far as possible, in an advisory manner.

Previous to the enactment of this law, but scant attention had been given to the gathering and comparing of facts, and operations were largely conducted upon theories as to underground conditions. As the theories were usually advanced by men of long experience, the ordinary usage assumed the misnomer of "practical methods."

Very gratifying results have followed three years of educational work, during which time both the department and the oil operators have advanced in knowledge of natural laws governing underground conditions.

As was to be expected in such work, a few operators have not readily adopted suggested changes in operations, and some do not yet realize their responsibility in protecting the oil fields, in which the public is vitally interested. Some changes in the law, therefore, will be necessary in order to make it thoroughly effective. Such changes will not affect individuals or corporations who are more interested in the spirit rather than the letter of the law.

Respectfully submitted.

FLETCHER HAMILTON,  
State Mineralogist.

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MR. FLETCHER HAMILTON,  
*State Mineralogist.*

SIR: In transmitting the Third Annual Report of the work of the Department of Petroleum and Gas, I believe it may be well to call attention to the fact that the usefulness of the department to the public requires absolute impartiality in dealing with the various producers, both large and small. It is a pleasure to record that the department has been given a free hand to discharge its duty.

Respectfully submitted.

R. P. McLAUGHLIN,  
State Oil and Gas Supervisor.

Public interest requires further legislation to compel proper operations by such concerns as are not receptive to educational methods of legal administration and still fail to recognize their obligations in the matter of protecting the oil deposits of California.

In our previous reports<sup>1</sup>, considerable attention was devoted to explaining and illustrating the elementary features upon which thorough development and protection of the oil fields rest. The present report omits the elementary principles and merely recites the actual work and developments of the past year. Such new principles as we have been able to thoroughly study are also described.

It should be particularly noted that a complete list of all operations upon which the department has passed is given in this and previous reports. The facts thus recorded will be found useful to careful investigators.

The policy of issuing recommendations to operators, rather than orders, has been continued. This provides elasticity in the system of supervising oil field operations, so that facts or conditions, subsequently discovered, can be informally presented by an operator and a supplementary recommendation issued. The greater portion of our work is carried on informally by consultation between field representatives of the department and the operators. The written records, however, cover all proposals and recommendations. It was necessary to issue only three formal orders:

ORDER No. 4, relative to State Consolidated Oil Company, Lloyd well No. 2.<sup>2</sup>

ORDER No. 5, relative to Union Oil Company, International well No. 7.<sup>3</sup>

ORDER No. 6, relative to Petroleum Midway Company, Ltd., Darlington well No. 1.<sup>4</sup>

There were, however, many instances in which the department did not approve operations, and the written records have merely been kept clear and complete so as to provide for such future legal action as may be necessary. Some of the operations which were not approved may never cause serious damage, and it is believed that ultimately more good will be accomplished by the past liberal or educational administration of the law than by drastic legal action. Formal orders, in general, have been issued on the following grounds:

- (1) At the request of the operator;
- (2) Where great and immediate damage seemed probable;
- (3) Where it appeared that the operator was defiant of legal restrictions.

<sup>1</sup>Bull. 73 and 82, Cal. State Min. Bur.

<sup>2</sup>Bull. 82, Cal. State Min. Bur. pp. 193-4.

<sup>3</sup>See pp. 413 to 450, *post*.

<sup>4</sup>See p. 213, *post*.

Legal action was taken in two instances<sup>1</sup> only, namely: against Thomas A. Slocum; and against I. W. Fuqua, as president, general manager and agent of the Red Star Petroleum Company.

The first action was taken on account of repeated failure to file records and was dismissed when the records were produced. The second action was taken where it appeared that deliberate attempts were being made to conceal information obtained during drilling operations. Conviction was not obtained. A change in the statutory provisions governing the department in such matters is necessary.

A marked improvement in field operations has taken place throughout the state since the enactment of the law, and more care is given by operators to the details necessary to the proper drilling of wells. On the other hand, attention is called to the fact that improvement has not been so widespread that legal supervision is no longer needed. Two new fields (Montebello and Casmalia), developed in the past two years, have already encountered water in menacing quantities. These fields are in the hands of large operators, and the difficulties follow directly upon their failure to co-operate with the department in the matter of careful engineering study and control. As has been repeatedly stated, the department has neither the facilities nor the inclination to originate plans directing, in detail, the operations of any concern. Proposed operations, particularly those of great volume, should be accompanied by carefully compiled data, supporting a well-considered plan. The concerns above mentioned have greatly retarded and discredited the administration of the law by attempting to shift upon the department the burden of planning operations.

Maps of all the oil fields have been completed and are on sale at our various offices at prices which merely cover the cost of blue printing. These maps are revised from time to time to show the latest developments. Such information has not, heretofore, been readily available to the public.

Models showing the geological and mechanical conditions have been constructed<sup>2</sup> and displayed at our various field offices. The number of persons calling for the purpose of inspecting these models, particularly at our Los Angeles office, indicates that the models are useful to the public, besides being necessary in the work of the department.

Office buildings were constructed at Coalinga and Taft, which have facilitated our work during the latter part of the year. The building at Taft will have to be enlarged in order to display models, which can now be rapidly assembled and made available for public use.

<sup>1</sup>The People of the State of California v. Thomas A. Slocum, p. 315. The People of the State of California v. I. W. Fuqua, pp. 208 to 211, *post*.

<sup>2</sup>Bull. No. 82, Cal. State Min. Bur. p. 64.

Several public meetings were held for the purpose of discussing details of certain field operations. A meeting at Los Angeles<sup>1</sup>, for the purpose of considering the use of mud fluid, was well attended, and several interesting, detailed papers were presented, and served as a basis for discussion. However, subsequent field operations demonstrated that the suggestions were not acted upon. A meeting at San Francisco, for the purpose of discussing the subject of proper and economical spacing of wells<sup>2</sup>, brought out but little definite information beyond that compiled by the department<sup>3</sup>. Several large concerns were not represented by engineers or others who were prepared to present detailed evidence that the subject had been seriously considered.

While the subject of the most economical spacing of wells might, at first glance, appear to be abstract and theoretical, it will be found that systematic observations, governed by common sense, will afford valuable information. It has long been recognized that wells drain territory for varying distances<sup>4</sup>, and it is self-evident that, if wells are too closely spaced, some of them are merely a waste of labor and material.

The department has made no extended or systematic investigation of the subject, but it has observed some striking instances. One of the best examples coming to our attention is shown by the accompanying diagram (Fig. 1), which shows the production of four wells over a period of nearly four years. It will be noted that, as each new well was completed there was a marked decline in productions of wells already producing. The new well drew much of its production from areas previously supplying adjoining wells. As a matter of fact, one well, or at the utmost two, would have produced as much oil.

The article by E. A. Starke (pp. 107 to 109, *post*), describing a process for the increased utilization of heavy oil, should be of particular interest to many producers. The policy of publishing original articles of public interest was established in our previous reports<sup>5</sup>.

Needless expense in oil field operations has repeatedly been mentioned in reports of this department. The special report by R. E. Collom, comparing results obtained from various methods of shutting off water, furnishes data which can be used to reduce present losses to an amount at least equal to the total expenditures by this department.

There has been a disposition, in some quarters, to belittle or discount previous statements as to inefficiency. It would appear unnecessary to do more than merely point out the results obtained by various large producers, as shown in the following table. It will be noted that the per-

<sup>1</sup>Pp. 77 to 106, *post*. Demonstrations of use of Mud-Laden Fluid in Oil Well Operations.

<sup>2</sup>Bull. No. 73, Cal. State Min. Bur. pp. 134 to 140.

<sup>3</sup>Diagram of International Wells. P. 11, *post*.

<sup>4</sup>Bull. No. 69, Cal. State Min. Bur. pp. 58-59.

<sup>5</sup>Bull. No. 73, Cal. State Min. Bur. pp. 228-233. Bull. No. 82, Cal. State Min. Bur. p. 81.

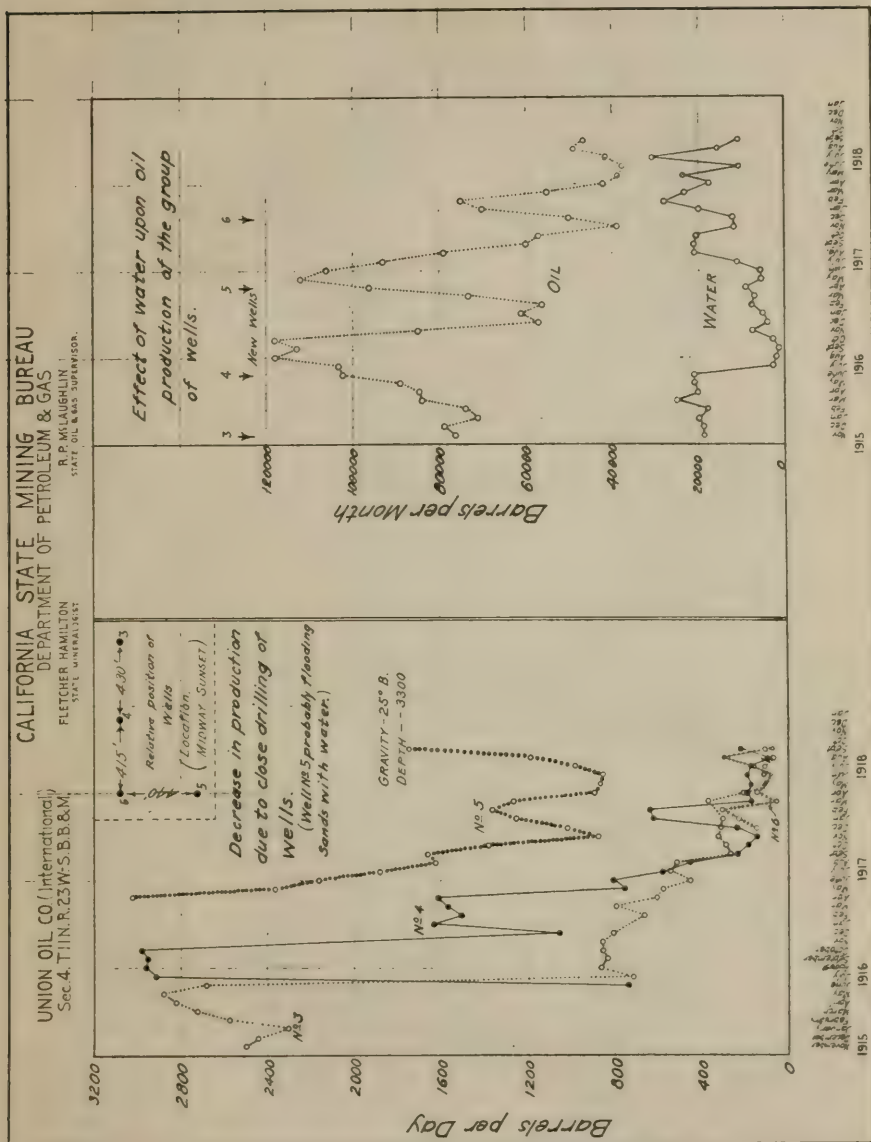


FIG. 1.

centage of successful work ranges from 93 down to 71. The largest producer in the state shuts off water successfully at less than three wells out of every four, while, on the other hand, the average of successful shut-offs among small operators is slightly better than nine out of ten.

Particular attention is called to the current statement that "efficient oil operations require that the industry be in the hands of large concerns."

TABLE 1.  
Comparison of Results Obtained by Certain Companies in Excluding Water From Oil Wells in California.  
July 1, 1917-June 30, 1918.

Counties	Associated			Doheny			General Petroleum			Southern Pacific			Standard		
	Shut-off success	Shut-off failure	Per cent of success	Shut-off success	Shut-off failure	Per cent of success	Shut-off success	Shut-off failure	Per cent of success	Shut-off success	Shut-off failure	Per cent of success	Shut-off success	Shut-off failure	Per cent of success
Los Angeles and Orange-----	8		100	6	5	55							38	25	60
Ventura-----					9	75									
Santa Barbara-----	29	4	88	28	4	87							2		100
Kern-----	13	3	81	4		100	49	11	82	59	19	76	52	16	77
Fresno-----	13	4	76	7		100				26	7	79	13	2	87
Totals-----	63	11	85	54	12	82	49	11	82	55	26	77	105	43	71

Comparison of Results Obtained by Certain Companies in Excluding Water From Oil Wells in California—Continued.

Counties	Union			Santa Fe			Honolulu			Shell			Total		
	Shut-off success	Shut-off failure	Per cent of success	Shut-off success	Shut-off failure	Per cent of success	Shut-off success	Shut-off failure	Per cent of success	Shut-off success	Shut-off failure	Per cent of success	Shut-off success	Shut-off failure	Per cent of success
Los Angeles and Orange-----	15	4	79	6	1	86							73	35	67
Ventura-----										12		100	11	3	79
Santa Barbara-----	20	2	91							3		100	82	10	89
Kern-----	9	6	60	37	6	86			100			226	61	79	
Fresno-----	2	1	66							50	4	93	111	18	86
Totals-----	46	13	78	43	7	86	3		100	55	4	93	503	127	80
All other operators-----													197	19	91
Grand totals*-----													700	146	83

\*Does not include 25 re cementing jobs, 22 of which were failures.

†Both jobs successful at test, but failed shortly afterwards.

Immediately upon the organization of the department, we were requested to make definite rules regulating the use of rotary tools. Stringent rules were not adopted because it appeared no definite evidence had been collected by the supporters of either the rotary or cable tools. It was also apparent that many claimants were unduly prejudiced in favor of one method or the other. The figures now available show that failures to shut off water occur very much oftener with rotary tools than with cable tools.

The extraordinary difficulty in properly drilling and protecting the Sunset field was pointed out in formal order No. 5, relative to Union Oil Company well No. 7, International. This order was held by some individuals to be too stringent. Attention is now called to the fact that only one-half of the attempts made in the Sunset field to shut off water in rotary holes are successful.

In the case where the department took legal action, charging falsification of drilling records, the future of the very productive Montebello field was at stake. The figures at hand now show that more than a third of the attempts to shut off water are failures. Therefore the department has no apologies to offer for exhausting all legal methods in attempting to protect this field.

Both the advantages of careful engineering work and the disadvantage of rotary tools are clearly set forth by the figures showing the percentage of failures in the Coalinga field. It will be noted that the difference between the success and failure of a shut-off frequently depends upon determining, within five feet, the depth at which a shut-off should be attempted. This can not be determined without geological and engineering work, and requires a log more accurate than can be obtained when rotary tools are used.

The department has frequently been called upon to make definite blanket rulings requiring the use of cement at all wells. We have avoided taking such a position on account of the lack of definite facts. It is, therefore, of special interest to note that a comparison of results shows that cement is not always necessary. In other words, the mere use of cement is not automatically a cure or preventative for all water troubles.

Some operators have argued that the use of large quantities of cement would protect all oil formations left back of a string of casing. This argument has been advanced particularly by some of the concerns having poor records for simple shut-off at the shoe of casing. Therefore, the burden of proof remains upon them.

There are several cementing concerns who do work by contract. Their varying percentage of success is shown by the figures.

There are numerous mechanical details which must be given careful attention if successful shut-offs are to be obtained. Sometimes operators

have indicated that the department is too strict. Such opinions are usually held by persons who have not had wide experience in observing such work, and the details set forth by Mr. Collom will show the careful reader that there is a basis of fact for our requirements.

### STATISTICS OF OIL PRODUCTION.

Monthly statistics for various fields and for the entire state are given here for the purpose of bringing records, previously published in Bulletins Nos. 69, 73 and 82, down to date. The figures as in previous publications, are those collected by the Standard Oil Company. They closely check those collected by the Independent Oil Producers' Agency and also the figures collected by this department in the form of sworn statements.

The Lost Hills and Belridge fields show the greatest decline in average daily production per well. All fields, except Lompoc and Santa Maria and Whittier-Fullerton, show a decline in production. It has already been noted that the increases for the Lompoc and Santa Maria field and the Whittier-Fullerton field are due, respectively, to the Casmalia and Montebello fields.

#### KERN RIVER.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1917—July .....	1,914	3	22,745	11.8
August .....	1,935	1	23,220	12.0
September .....	1,959	3	22,835	11.7
October .....	1,964	1	22,555	11.5
November .....	1,966	5	22,510	11.4
December .....	1,960	2	22,325	11.3
1918—January .....	1,975	-----	21,855	11.1
February .....	1,975	2	21,985	11.1
March .....	1,970	2	22,300	11.3
April .....	1,966	1	22,450	11.4
May .....	1,970	3	22,244	11.3
June .....	1,917	3	21,504	11.2

#### McKITTRICK.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1917—July .....	305	4	8,897	28.2
August .....	307	3	9,048	29.5
September .....	309	1	8,482	27.4
October .....	311	2	8,213	26.4
November .....	312	1	8,485	27.2
December .....	309	2	8,673	28.1
1918—January .....	314	2	8,661	27.6
February .....	317	1	8,314	26.2
March .....	309	3	8,302	26.9
April .....	316	3	8,356	26.4
May .....	321	-----	8,146	25.4
June .....	303	3	8,651	28.6

## MIDWAY-SUNSET.

		Number of wells		Average daily production in barrels	
		Producing	Completed	Total	Per well
1917	July	1,865	25	99,349	53.2
	August	1,898	24	105,064	55.4
	September	1,923	29	100,260	52.0
	October	1,956	19	98,740	50.5
	November	1,982	21	97,266	49.0
	December	1,997	19	96,947	48.5
1918	January	2,014	31	97,606	48.5
	February	2,046	22	97,962	47.9
	March	2,065	18	95,334	46.1
	April	2,085	14	97,010	46.5
	May	2,694	18	97,916	44.4
	June	2,114	17	94,048	44.5

## LOST HILLS AND BELRIDGE.

		Number of wells		Average daily production in barrels	
		Producing	Completed	Total	Per well
1917	July	428	14	18,412	43.6
	August	445	12	18,172	40.8
	September	456	8	18,428	40.4
	October	463	11	17,947	38.8
	November	473	10	17,345	34.7
	December	485	7	17,373	35.8
1918	January	491	3	16,973	34.5
	February	491	5	15,841	32.2
	March	496	2	15,709	31.6
	April	498	6	15,687	31.4
	May	507	6	14,867	29.3
	June	503	2	14,251	28.4

## COALINGA.

		Number of wells		Average daily production in barrels	
		Producing	Completed	Total	Per well
1917	July	1,005	13	42,930	42.7
	August	1,018	12	42,962	42.2
	September	1,031	9	43,945	42.5
	October	1,031	12	43,449	42.1
	November	1,048	11	44,007	42.0
	December	1,638	16	44,925	43.2
1918	January	1,063	8	46,060	43.3
	February	1,068	4	45,086	42.3
	March	1,064	8	43,903	41.2
	April	1,067	7	45,071	42.2
	May	1,075	9	45,125	42.0
	June	1,130	12	44,842	39.7

## LOMPOC AND SANTA MARIA.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1917—July .....	263	8	15,544	59.1
August .....	269	7	15,965	59.3
September .....	278	9	16,680	61.0
October .....	285	6	17,870	62.7
November .....	291	6	17,765	61.0
December .....	300	5	20,340	67.8
1918—January .....	309	6	18,545	60.0
February .....	309	7	19,775	64.0
March .....	313	8	17,913	57.3
April .....	328	5	21,355	65.1
May .....	331	-----	19,577	59.1
June .....	334	2	20,549	61.5

## VENTURA-NEWHALL.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1917—July .....	473	1	3,484	7.4
August .....	467	2	3,387	7.3
September .....	461	2	3,623	7.9
October .....	452	1	3,674	8.1
November .....	445	1	3,348	7.5
December .....	451	1	3,234	7.2
1918—January .....	447	4	3,073	6.9
February .....	463	3	3,020	6.5
March .....	462	4	3,277	7.1
April .....	467	4	3,173	6.8
May .....	471	4	3,325	7.0
June .....	463	3	3,754	8.1

## LOS ANGELES AND SALT LAKE.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1917—July .....	610	-----	3,990	6.0
August .....	662	-----	3,920	5.9
September .....	662	-----	4,198	6.3
October .....	662	-----	4,100	6.2
November .....	665	1	3,993	6.0
December .....	683	-----	4,038	5.9
1918—January .....	662	-----	3,962	6.0
February .....	662	-----	3,822	5.8
March .....	661	-----	3,923	5.9
April .....	661	-----	3,825	5.9
May .....	661	-----	3,853	5.8
June .....	667	-----	3,471	5.2

## WHITTIER-FULLERTON.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1917—July .....	679	6	42,485	64.0
August .....	683	7	49,787	73.0
September .....	693	5	55,954	80.7
October .....	686	4	54,533	78.8
November .....	699	7	55,457	79.3
December .....	704	3	55,251	78.5
1918—January .....	703	8	54,024	77.0
February .....	710	7	56,632	79.9
March .....	713	6	56,778	79.7
April .....	713	8	59,321	83.1
May .....	715	8	64,896	90.7
June .....	714	4	71,602	100.3

## SUMMERLAND.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1917—July .....	112	-----	155	1.4
August .....	112	-----	155	1.4
September .....	112	-----	155	1.4
October .....	112	-----	155	1.4
November .....	112	-----	155	1.4
December .....	112	-----	155	1.4
1918—January .....	112	-----	156	1.4
February .....	112	-----	155	1.4
March .....	112	-----	155	1.4
April .....	142	-----	148	1.0
May .....	142	-----	140	1.0
June .....	142	-----	149	1.0

## WATSONVILLE.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1917—July .....	5	-----	75	15.0
August .....	5	-----	75	15.0
September .....	5	-----	75	15.0
October .....	5	-----	75	15.0
November .....	5	-----	75	15.0
December .....	5	-----	75	15.0
1918—January .....	5	-----	75	15.0
February .....	5	-----	75	15.0
March .....	5	-----	75	15.0
April .....	5	-----	75	15.0
May .....	5	-----	74	14.8
June .....	5	-----	75	15.0

## OIL PRODUCTION, JUNE, 1918.

The extent to which oil is produced by various large concerns is shown by the following table for June, 1918:

Company	Coalinga				Kern River				McKittrick			
	Oil (bbls.)	Per cent	Wells	Per cent	Oil (bbls.)	Per cent	Wells	Per cent	Oil (bbls.)	Per cent	Wells	Per cent
Associated Oil Company <sup>1</sup>	979	2.2	59	5.2	8,112	37.7	507	26.4	16.0	2,125	83	27.4
Doheny companies <sup>2</sup>	3,682	8.2	102	9.0								
General Petroleum Corporation	358	.8	16	1.4								
Honolulu Consolidated Oil Company												
Atchison, Topeka and Santa Fe Railway Company (Fuel Department) <sup>3</sup>	19,199	42.8	235	20.8	671	3.1	122	6.4	5.5			
Shell Company of California												
Southern Pacific Company (Fuel Oil Department)	7,283	16.2	178	15.8	1,201	5.6	231	12.1	5.2	1,186	46	15.2
Standard Oil Company	3,637	8.2	137	12.1	Report's incom plete.				141	1.6	6	2.0
Union Oil Company of California	641	1.4	23	2.0								
Other companies	9,045	20.2	380	33.7	11,520	53.6	1,057	55.1	10.9	5,249	168	55.4
Totals <sup>4</sup>	44,842	100	1,130	100	21,504	100	1,917	100	11.2	8,651	303	100

Company	Midway-Sunset				Lost Hills-Petridge				Los Angeles-Salt Lake			
	Oil (bbls.)	Per cent	Wells	Per cent	Oil (bbls.)	Per cent	Wells	Per cent	Oil (bbls.)	Per cent	Wells	Per cent
Associated Oil Company <sup>1</sup>	4,905	5.2	96	4.5	1,954	13.7	48	9.6	40.7	1,746	148	50.7
Doheny companies <sup>2</sup>	6,670	6.8	153	6.9	627	4.4	26	5.2	24.1	187	9	3.1
General Petroleum Corporation	5,732	6.1	103	7.7	5,265	36.6	183	36.4	28.5			
Honolulu Consolidated Oil Company	3,632	3.9	35	1.6								
Atchison, Topeka and Santa Fe Railway Company (Fuel Department) <sup>3</sup>	8,690	9.2	213	10.1								
Shell Company of California												
Southern Pacific Company (Fuel Oil Department)	14,476	15.4	226	16.7								
Standard Oil Company	13,504	14.4	352	16.7	1,188	8.3	55	16.9	21.6			
Union Oil Company of California	2,944	3.1	30	1.4	1.2	.9	6	1.2	20.9			
Other companies	33,475	35.9	846	40.4	5,152	36.1	185	36.7	27.8	1,588	135	46.2
Totals <sup>4</sup>	94,048	100	2,114	100	14,251	100	593	100	28.3	3,471	100	100

## OIL PRODUCTION, JUNE, 1918—Continued.

Company	Whittier-Fullerton				Ventura-Newhall				Santa Maria-Lompoc			
	Oil (bbls.)	Per cent	Wells	Per cent	Bbls. per well	Oil (bbls.)	Per cent	Wells	Per cent	Oil (bbls.)	Per cent	Bbls. per well
Associated Oil Company <sup>1</sup>	3,612	5.0	84	11.8	43.0					2,150	10.5	23
Doheny companies <sup>2</sup>	3,580	5.0	4	.5	895.3	302	8.1	48	10.4	5,061	29.0	37
General Petroleum Corporation	725	1.0	37	5.2	19.6	42	1.1	1	0.2			
Honolulu Consolidated Oil Company												
Union Oil Company of California												
Atchison, Topeka and Santa Fe Railway Company (Fuel Department) <sup>3</sup>	1,892	2.5	77	10.8	23.4							
Shell Company of California						34	0.9	1	0.2			
Southern Pacific Company (Fuel Oil Department)												
Standard Oil Company	45,240	63.2	156	21.8	290.0	234	6.2	65	14.0			
Union Oil Company of California	8,621	12.5	94	13.2	94.9	407	16.9	83	17.9	9,893	48.1	191
other companies	7,722	10.8	262	36.7	29.5	2,735	72.8	265	57.3	2,545	12.4	83
Totals <sup>4</sup>	71,662	100	714	100	100.5	3,754	100.0	463	100.0	20,549	100.0	334

## OIL PRODUCTION, JUNE, 1918—Continued.

Company	Total state				Total state			
	Oil (bbls.)	Per cent	Wells	Per cent	Oil (bbls.)	Per cent	Wells	Per cent
Associated Oil Company <sup>1</sup>	25,583	9.1	1,048	13.5				
Doheny companies <sup>2</sup>	20,950	7.3	379	4.9				
General Petroleum Corporation	12,082	4.3	400	5.1				
Honolulu Consolidated Oil Company	3,632	1.3	35	0.4				
Atchison, Topeka and Santa Fe Railway Company (Fuel Department) <sup>3</sup>	11,163	4.0	412	5.3				
Shell Company of California	19,233	6.8	236	3.0				
Southern Pacific Company (Fuel Oil Department)	24,096	8.5	681	8.8				
Standard Oil Company	63,964	22.6	771	9.9				
Union Oil Company of California	22,631	8.1	427	5.5				
Other companies	79,029	28.0	3,381	43.6				
Totals <sup>4</sup>	282,672	100.0	7,770	100.0				

<sup>1</sup>Includes Amalgamated Oil Company.<sup>2</sup>Includes American Oilfields Company, American Petroleum Company, California Star Oil Company, Doheny-Pacific Petroleum Company, Midland Oil Company, Midland Oilfields Company, Niles Lease Company, Pan-American Petroleum Company, Pan-American Investment Corporation, Petroleum Midway Company, Ltd., Red Star Petroleum Company.<sup>3</sup>Includes Chanslor-Canfield Midway Oil Company, Petroleum Development Company.

**PROVED OIL LAND AND DEGREE OF DEVELOPMENT.**

The extent of ownership or control of proved oil land, and degree of development, is shown in the following table. A similar tabulation was made by the writer for the year 1914, in Bulletin 69<sup>1</sup>. The amounts given under "acres per well" in the present tabulation show to what extent the proved lands of various concerns have been drilled. There has been an increase of 20 per cent in the total proved acreage of the state, and an increase of 10 per cent in the number of wells producing. It must be remembered that the figures of four years ago were compiled under conditions less favorable to accuracy than exist now. Therefore the comparisons must be liberally interpreted.

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<sup>1</sup>Petroleum Industry of California, Bull. 69, Cal. State Min. Bur. pp. 14-17.

## COMPARISON OF OWNERSHIP OR CONTROL OF PROVED OIL LAND AND DEGREE OF DEVELOPMENT, JUNE, 1918.

Company	Coalhiga			Kern River			McKittrick			Midway-Sunset			Lost Hills-Belridge		
	Acres	Wells	Acres per well	Acres	Wells	Acres per well	Acres	Wells	Acres per well	Acres	Wells	Acres per well	Acres	Wells	Acres per well
Associated Oil Company <sup>1</sup> .....	560	59	9.5	2,397	577	4.7	543	83	6.5	1,520	46	15.8	375	48	6.4
Doheny companies <sup>2</sup> .....	1,117	102	10.9							1,974	153	12.9	105	26	4.0
General Petroleum Corporation.....	140	16	10.0							1,349	163	8.3	993	183	5.3
Honolulu Consolidated Oil Company.....										2,701	35	77.2			
Atchison, Topeka and Santa Fe Railway Company (Fuel Department) <sup>3</sup> .....	2,432	235	10.3	145	122	1.2				2,721	213	12.8			
Shell Company of California.....															
Southern Pacific Company (Fuel Oil Department).....	4,516	178	25.4	437	231	1.9	185	46	4.0	13,129	226	58.1			
Standard Oil Company.....	760	137	5.6	265	80	3.3	60	6	10.0	5,206	352	14.8	491	55	8.9
Union Oil Company of California.....	230	23	10.0							810	30	27.0	40	6	6.7
Other companies.....	3,218	280	8.4	3,691	977	3.8	654	168	3.9	16,106	846	19.0	1,150	185	6.2
Totals.....	12,963	1,430	11.5	6,985	1,917	3.6	1,442	303	4.8	45,516	2,114	21.5	3,054	503	6.1

## COMPARISON OF OWNERSHIP OR CONTROL OF PROVED OIL LAND AND DEGREE OF DEVELOPMENT, JUNE, 1918—Continued.

Company	Los Angeles-Salt Lake			Whittier-Fullerton			Ventura-Newhall			Santa Maria-Lompoc			Total state		
	Acres	Wells	Acres per well	Acres	Wells	Acres per well	Acres	Wells	Acres per well	Acres	Wells	Acres per well	Acres	Wells	Acres per well
Associated Oil Company <sup>1</sup> .....	803	148	5.4	470	84	5.6				749	23	32.6	7,347	1,048	7.0
Doheny companies <sup>2</sup> .....	19	9	2.1	35	4	8.7							4,286	379	11.3
General Petroleum Corporation.....				102	37	2.8	136	48	2.8	900	37	24.3	2,584	400	6.5
Honolulu Consolidated Oil Company.....							10	1	10.0				2,701	35	77.2
Atchison, Topeka and Santa Fe Railway Company (Fuel Department) <sup>3</sup> .....				231	77	3.0							3,097	412	7.5
Shell Company of California.....							10	1	10.0				2,442	236	10.3
Southern Pacific Company (Fuel Oil Department).....													18,267	681	26.8
Standard Oil Company.....				1,264	156	2.2	141	65	2.2				8,187	851	9.6
Union Oil Company of California.....				1,279	94	13.6	245	83	3.0	5,594	191	29.3	8,198	427	19.2
Other companies.....	185	135	1.4	1,220	262	4.7	1,385	265	5.2	2,552	83	30.7	30,171	3,301	9.1
Totals.....	1,017	292	3.5	4,601	714	6.4	1,927	463	4.2	9,795	334	29.3	87,280	7,770	11.2

<sup>1</sup>Includes Amalgamated Oil Company.

<sup>2</sup>Includes American Oilfields Company, American Petroleum Company, California Star Company, Doheny-Pacific Petroleum Company, Midland Oil Company, Midland Oilfields Company, Niles Lease Company, Pan-American Petroleum Company, Pan-American Petroleum Investment Corporation, Petroleum Midway Company, Red Star Petroleum Company.

<sup>3</sup>Includes Petroleum Development and Chanslor-Cunfield Midway Oil Company.

Comparison of the present extent and development of our proved land with that of four years ago affords some very valuable information. The enlargement of the total proved acreage is probably the most significant and gratifying feature. It emphasizes the fact that it is extremely difficult to forecast the extent of our oil resources, and should serve to restrain pessimistic forecasters. On the other hand, it must be realized that the oil resources have a definite limitation which forbids wasteful production or use.

The acreage per well has not greatly changed, and shows that there still remains a wide margin for development of the proved land. The yield per well will, of course, be expected to decline along with the increased development. The margin for development of proved land remaining for each of the various large concerns is of interest to investors and the public; but, of course, this margin must be liberally interpreted.

The increase in the number of wells owned by the various large concerns includes the wells acquired by purchase and also new wells drilled.

The percentage of the total proved area owned by the various large concerns has not greatly changed. In other words, the danger of monopoly of the oil lands is no nearer than it was four years ago.

The great increase in the proportion of oil produced by the Standard Oil Company—22.6 per cent as against 9.4 per cent—is evidence of the reward following active development campaigns.

The fact that just nine concerns own or control as much as 65 per cent of the oil land in the state, which yields fully 72 per cent of the production of the state, is ample explanation of the policy of this department in setting forth in considerable detail the operations and holdings of these large companies. Several of the concerns, through their position as regular marketers, also exercise a strong control over the operations of many others. The responsibility of the large concerns for the care and protection of our oil fields is, therefore, obvious, and the department has given particular attention to seeing that they adopted and followed the most approved methods. It should be clearly and unmistakably understood that in the past some of the largest operators have also been the most careless and wasteful. That condition is now being remedied, but the task is not yet completed.<sup>1</sup>

The proportion of water and oil produced by certain concerns in the various fields of the state is shown by the accompanying diagram.

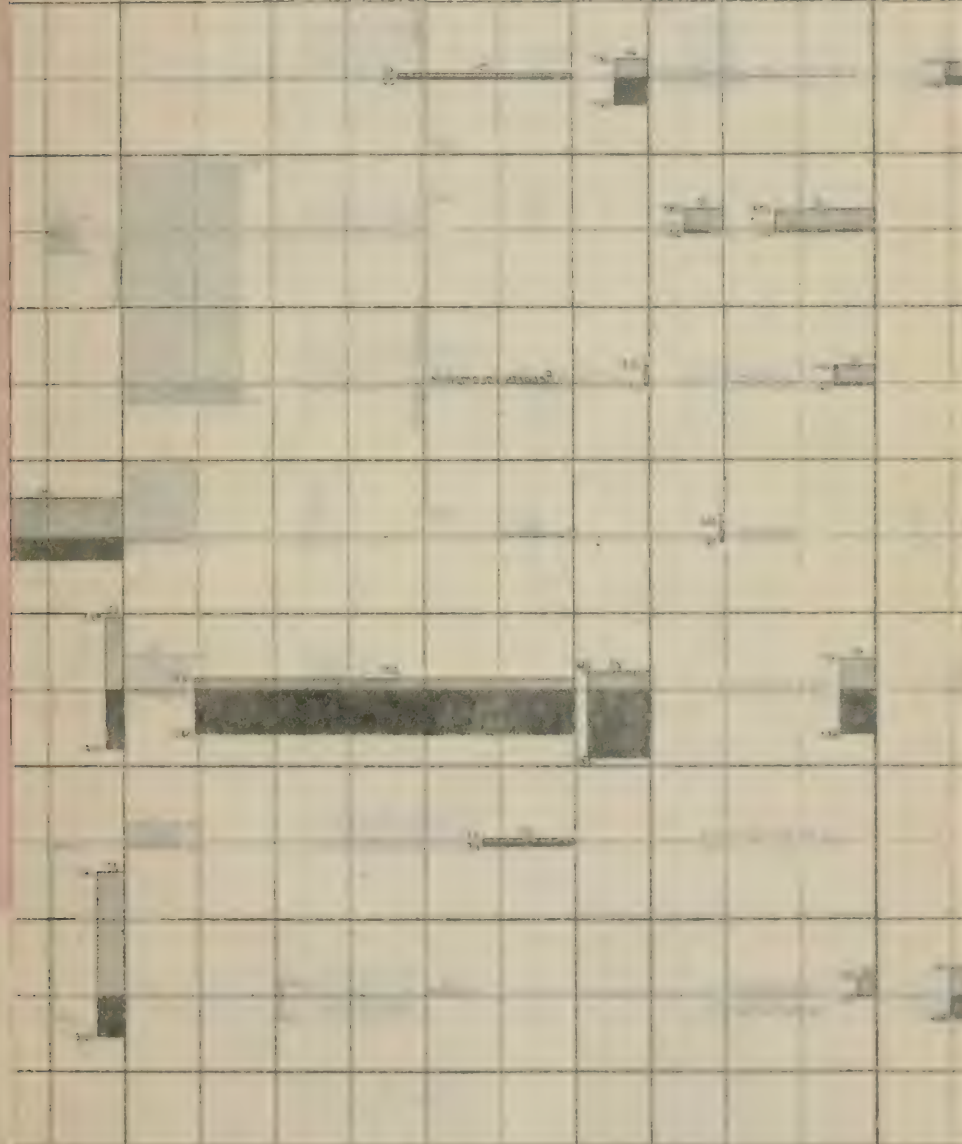
#### COLLECTION OF FUNDS BY ASSESSMENT.

The collection of funds by assessment is provided for in chapter 718 of the Statutes of 1915, amended 1917, a copy of which may be obtained

<sup>1</sup>Bull. No. 69, Cal. State Min. Bur. p. 4.

NEAR RIVER FIELD

LOST HILLS FIELD, BELMONT FIELD



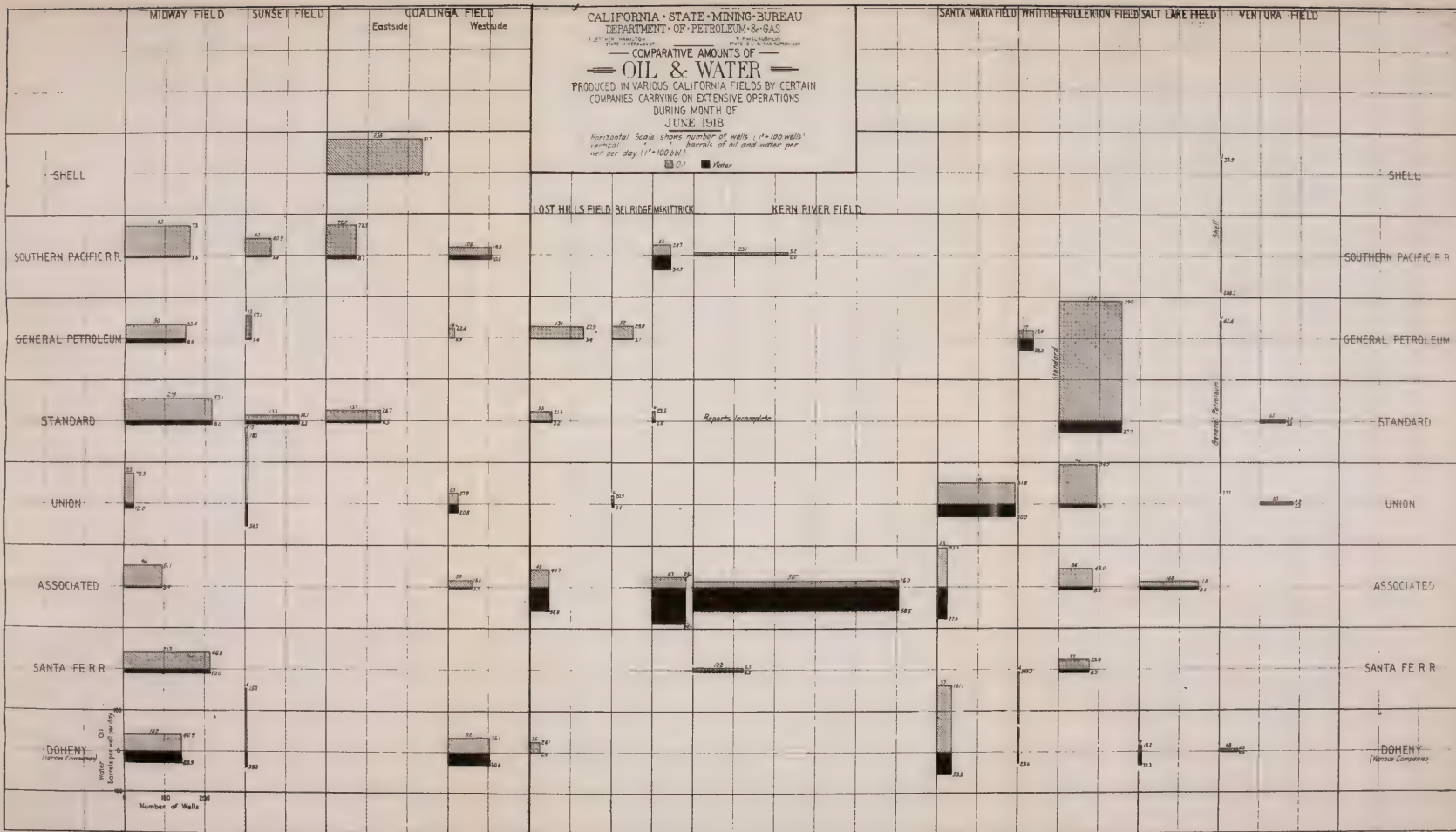


FIG. 2.

in convenient form by addressing the State Mineralogist, Ferry Building, San Francisco.

The money received from collection of the assessment comprises the petroleum and gas fund and is used for the support of the Petroleum Department of the State Mining Bureau, and for the repair of oil wells. The rates, shown on the accompanying statement and used in determining the various items, are determined in accordance with sections 23, 24, 25, 27, 46 and 47 of the said statute. The detailed method is as follows:

The amount of money to be raised annually, as provided in section 27, is sufficient to maintain the petroleum and gas fund at an amount not exceeding one hundred fifty thousand dollars. The amount this year is one hundred twenty-eight thousand three hundred seventy-five dollars. One-tenth of the above mentioned sum of one hundred twenty-eight thousand three hundred seventy-five dollars is levied upon the oil land of the state. The remaining nine-tenths is levied upon the oil produced and the gas produced and sold. For the purpose of this assessment ten thousand cubic feet of gas is considered equal to one barrel of oil. The amounts of land, oil and gas and the number of producing wells in the various counties were determined to be as follows:

County	Land (acres)	Oil (bbls.)	Gas (10 M.)	Wells (number)
Fresno .....	12,993	16,146,797	50,189	1,121
Kern .....	56,947	52,688,711	1,927,506	4,716
Los Angeles .....	2,401	4,357,162	24,175	748
Orange .....	2,418	14,568,990	655,927	467
Ventura .....	726	989,726	.....	355
Santa Barbara .....	9,023	5,589,223	60,157	385
San Luis Obispo .....	772	74,143	.....	18
Santa Clara .....	30	18,855	.....	14
Totals .....	87,200	94,433,547	2,726,054	7,894

Expenditure in repairing wells is to be repaid by satisfaction of a lien upon the property where the work is done. The rates applied in levying the total assessment are \$.146 per acre of oil land and \$.00119 per barrel of oil or per ten thousand cubic feet of gas.

### FINANCIAL STATEMENT.

By W. W. THAYER, SECRETARY.

#### CALIFORNIA STATE MINING BUREAU.

##### RECEIPTS.

Balance from sixty-eighth fiscal year .....	\$65,345 05
Receipts of 1916 assessments .....	2,168 44
Receipts of 1917 assessments .....	43,368 94
Reimbursements of Fund:	
Salaries .....	\$117 26
Miscellaneous .....	28 94
.....	146 20
Total receipts .....	\$111,028 63

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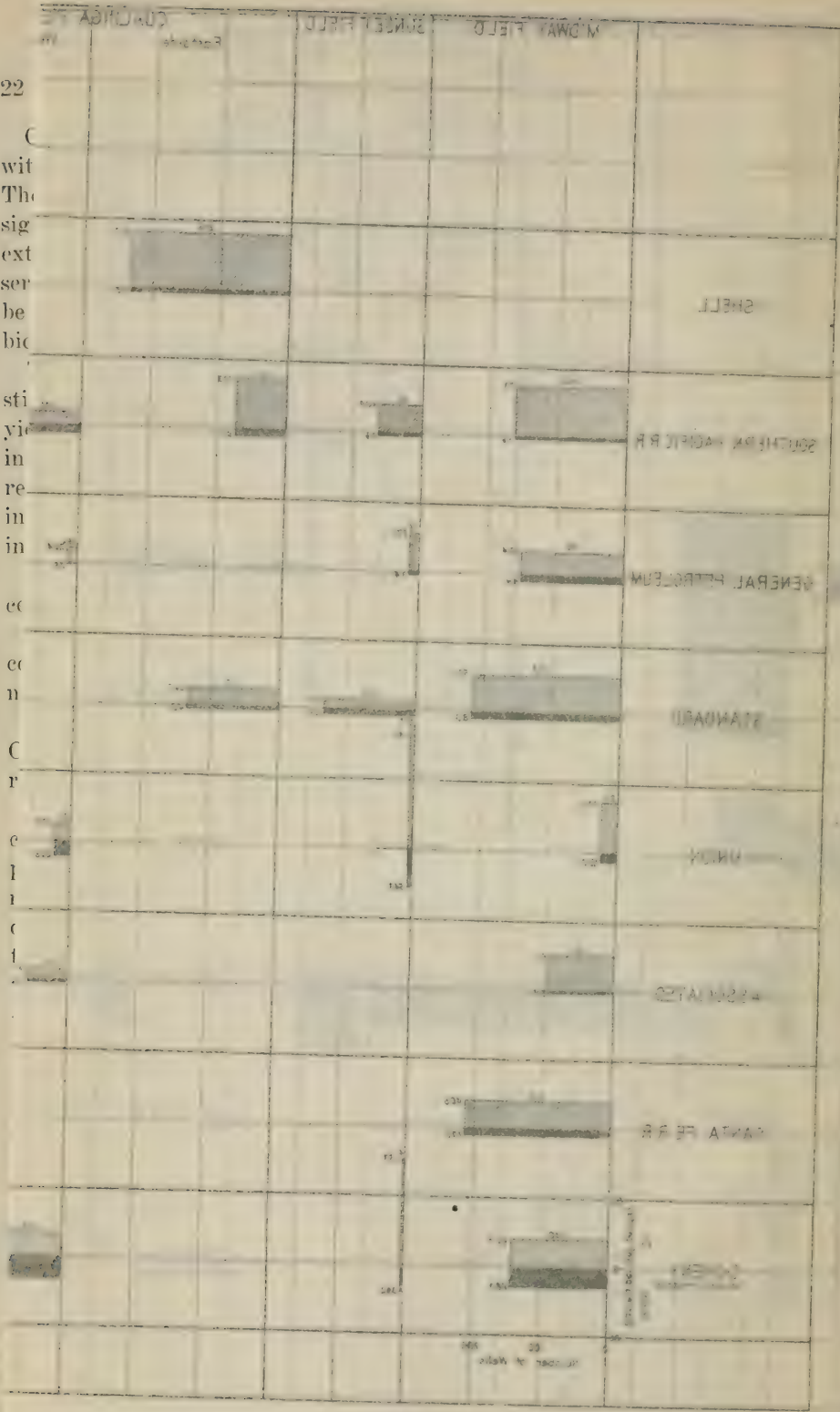
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in convenient form by addressing the State Mineralogist, Ferry Building, San Francisco.

The money received from collection of the assessment comprises the petroleum and gas fund and is used for the support of the Petroleum Department of the State Mining Bureau, and for the repair of oil wells. The rates, shown on the accompanying statement and used in determining the various items, are determined in accordance with sections 23, 24, 25, 27, 46 and 47 of the said statute. The detailed method is as follows:

The amount of money to be raised annually, as provided in section 27, is sufficient to maintain the petroleum and gas fund at an amount not exceeding one hundred fifty thousand dollars. The amount this year is one hundred twenty-eight thousand three hundred seventy-five dollars. One-tenth of the above mentioned sum of one hundred twenty-eight thousand three hundred seventy-five dollars is levied upon the oil land of the state. The remaining nine-tenths is levied upon the oil produced and the gas produced and sold. For the purpose of this assessment ten thousand cubic feet of gas is considered equal to one barrel of oil. The amounts of land, oil and gas and the number of producing wells in the various counties were determined to be as follows:

County	Land (acres)	Oil (bbls.)	Gas (10 M.)	Wells (number)
Fresno -----	12,993	16,146,797	59,189	1,121
Kern -----	56,947	52,688,711	1,927,506	4,716
Los Angeles -----	2,401	4,357,162	24,175	748
Orange -----	3,418	14,568,930	655,027	467
Ventura -----	1,726	989,726	-----	355
Santa Barbara -----	9,023	5,589,223	69,157	385
San Luis Obispo -----	772	74,143	-----	18
Santa Clara -----	80	18,855	-----	14
Totals -----	87,330	94,433,547	2,726,054	7,834

Expenditure in repairing wells is to be repaid by satisfaction of a lien upon the property where the work is done. The rates applied in levying the total assessment are \$.146 per acre of oil land and \$.00119 per barrel of oil or per ten thousand cubic feet of gas.

## FINANCIAL STATEMENT.

By W. W. THAYER, Secretary.

### CALIFORNIA STATE MINING BUREAU.

#### RECEIPTS.

Balance from sixty-eighth fiscal year		\$65,345 05
Receipts of 1916 assessments		2,168 41
Receipts of 1917 assessments		43,368 94
Reimbursements of Fund:		
Salaries	\$117 26	
Miscellaneous	28 94	146 20
Total receipts		\$111,028 60

## DISBURSEMENTS.

## Office of Headquarters:

Salaries -----	\$23,426 91
Traveling expenses -----	1,781 93
General expenses -----	5,152 20
Equipment -----	4,288 07
Printing -----	1,859 86

Total ----- \$36,508 97

## Los Angeles Office:

Salaries -----	\$10,082 41
Traveling expenses -----	619 09
General expenses -----	3,031 38
Equipment -----	1,153 21

Total ----- 14,886 09

## Coalinga Office:

Salaries -----	\$6,047 58
Traveling expenses -----	423 40
General expenses -----	1,919 45
Equipment -----	894 59
Cost of building -----	44 51

Total ----- 9,329 53

## Taft Office:

Salaries -----	\$12,438 64
Traveling expenses -----	910 57
General expenses -----	5,118 07
Equipment -----	1,313 50
Cost of building -----	50 24

Total ----- 19,831 02

## Santa Maria Office:

Salaries -----	\$4,879 35
Traveling expenses -----	652 00
General expenses -----	1,479 06
Equipment -----	126 45

Total ----- 7,136 86

## Santa Paula Office:

Salaries -----	\$1,950 00
Traveling expenses -----	240 90
General expenses -----	677 22
Equipment -----	557 45

Total ----- 3,425 57

Total expenditures ----- \$91,118 04

Unexpended balance ----- 19,910 59

Totals ----- \$111,028 63 \$111,028 63

## Delinquent assessments:

1916 assessments -----	\$5,089 29
1916 penalties -----	636 20
	\$5,725 49
1917 assessments -----	\$1,789 68
1917 penalties -----	220 37
	2,010 05

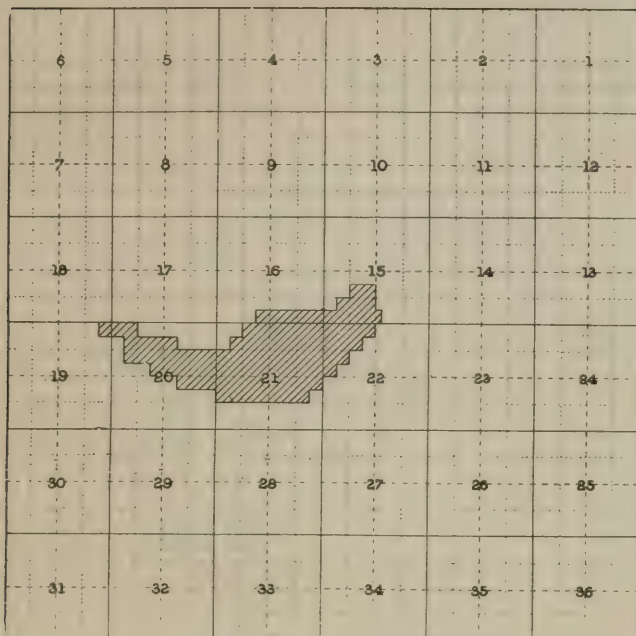
The above is a Statement of Receipts and Disbursements from the Petroleum and Gas Fund (Chapter 718, Statutes 1915, Amended 1917) for the Department of Petroleum and Gas for the period July 1, 1917, to June 30, 1918; also showing total amount of delinquent and uncollected assessments on June 30, 1918.

W. W. THAYER,  
Secretary.

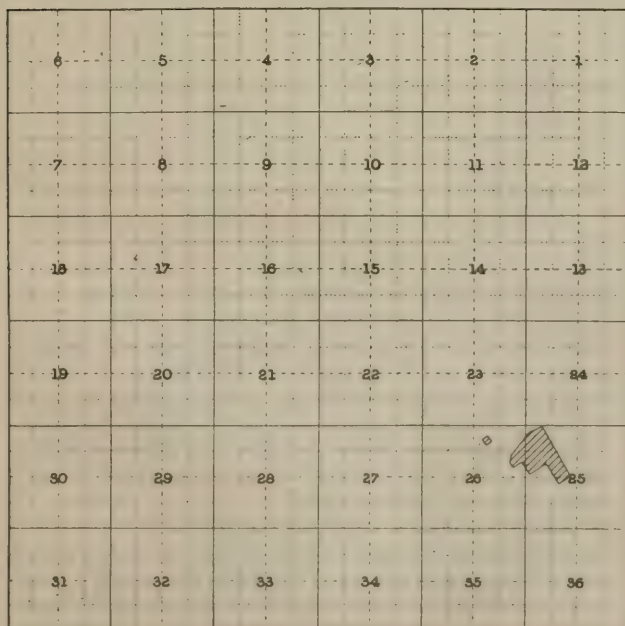
## PROVED OIL LAND ASSESSED.

MARCH 4, 1918.

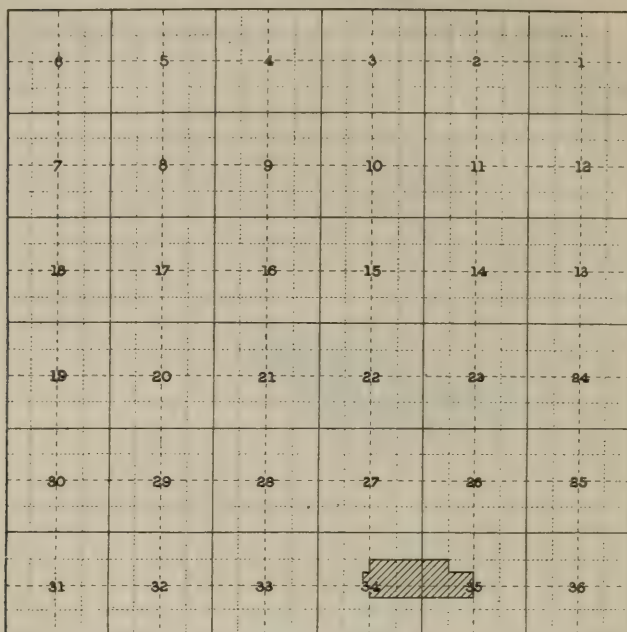
T.1 S., R.14 W., S.B.M. - LOS ANGELES COUNTY.



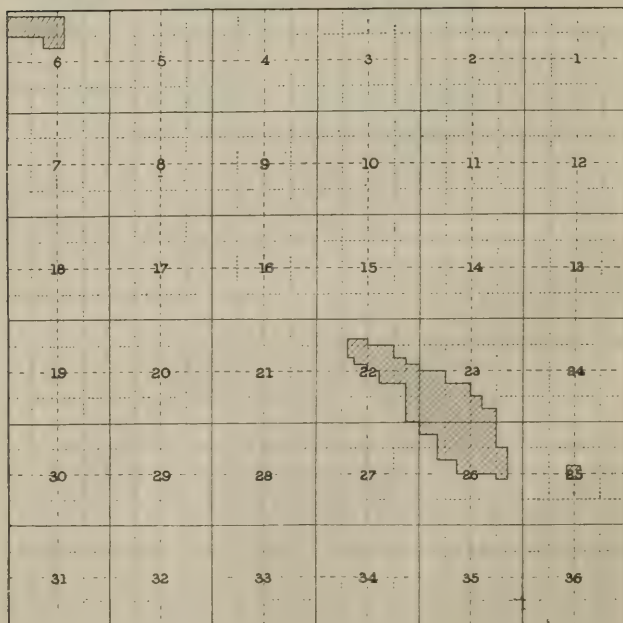
T.1 S., R.15 W., S.B.M. - LOS ANGELES COUNTY.



## T.2 S..R.10W. S.B. M. - LOS ANGELES COUNTY.



## T.2 S..R.11W. S.B. M. - LOS ANGELES COUNTY.





## T. 2 S., R. 12 W., S. B. M. - LOS ANGELES COUNTY.

6	5	4	3	2	1
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36




## T. 3 S., R. 11 W., S. B. M. - LOS ANGELES COUNTY.

6	5	4	3	2	1
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36

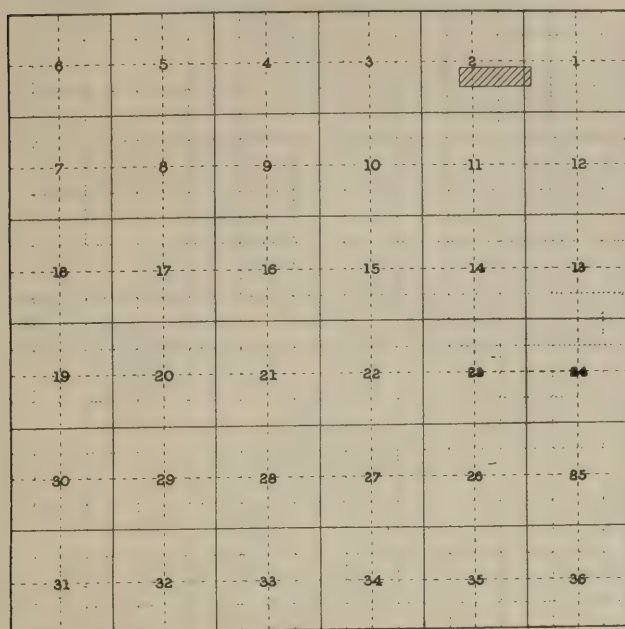
## T. 3N. R. 15W., S.B.M. — LOS ANGELES COUNTY.

6 	5	4	3	2	1
 7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

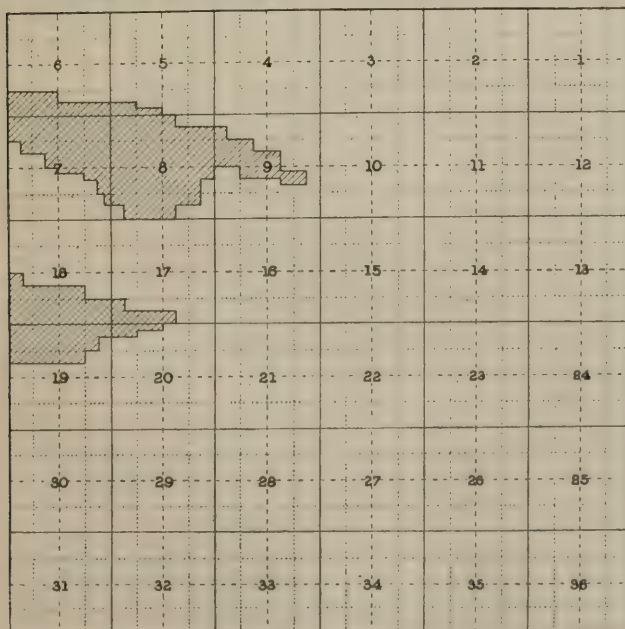
## T. 3N. R. 16W., S.B.M. — LOS ANGELES COUNTY.

6	5	4	3	2	1
7	8	9	10	11	12 
18	17	16 	15	14	13 
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

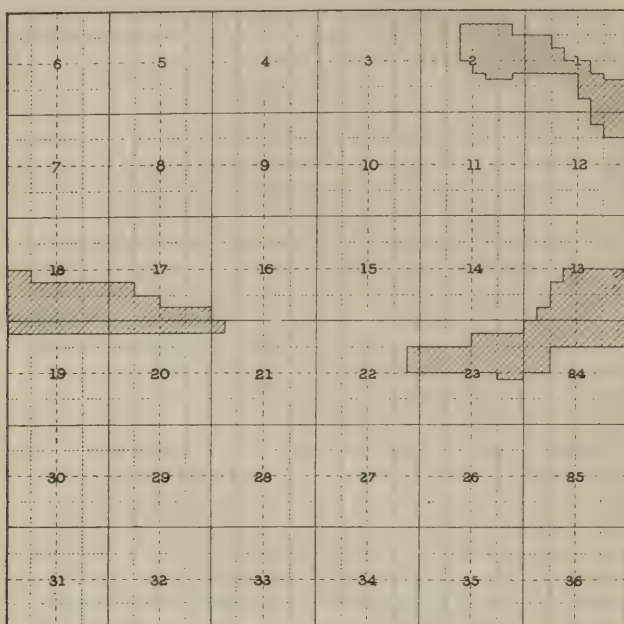
## T. 3 N. . R. 17 W. . S. B. M. - LOS ANGELES COUNTY.



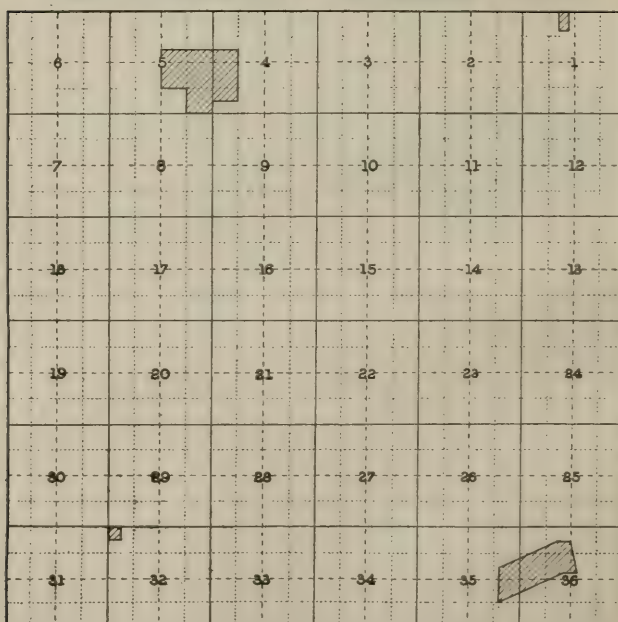
## T. 3 S. . R. 9 W. . S. B. M. - ORANGE COUNTY.



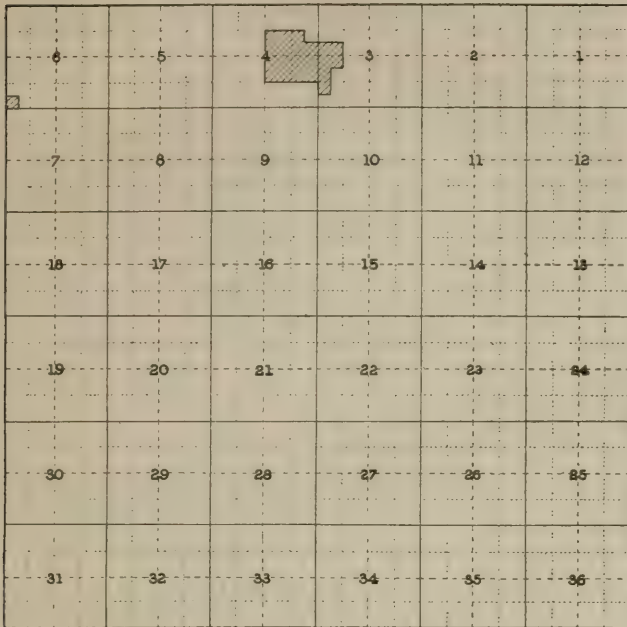
## T. 3 S. R. 10 W. S. B. M. - ORANGE COUNTY.



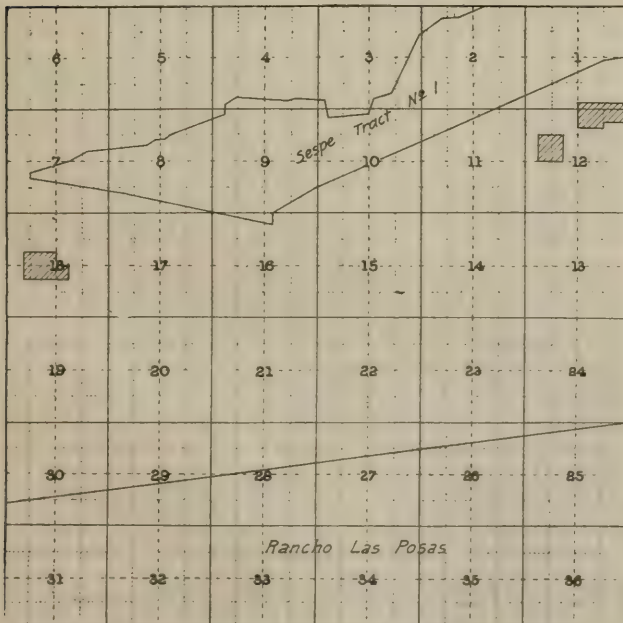
## T. 3 N. R. 18 W. S. B. M. - VENTURA COUNTY.



T.3N. R.19W., S.B.M. — VENTURA COUNTY.



T.3N. R.20W., S.B.M. — VENTURA COUNTY.



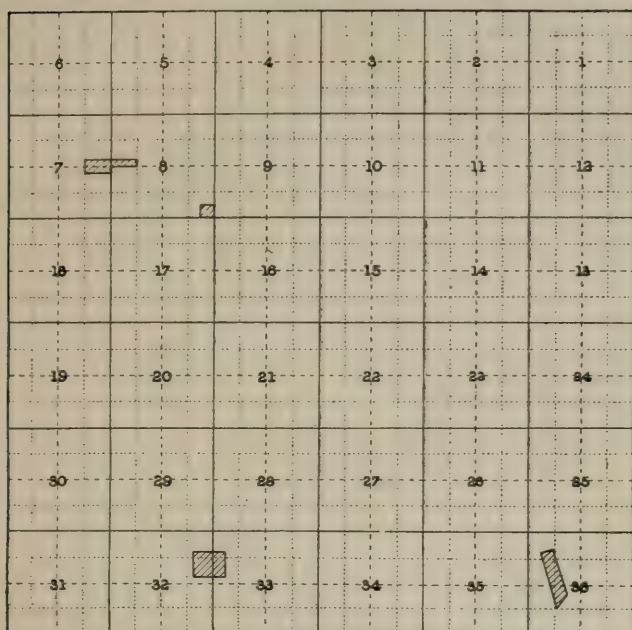
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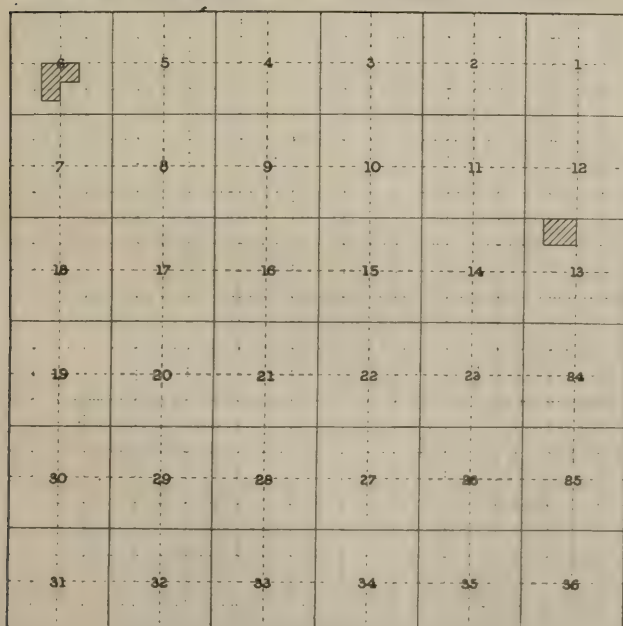
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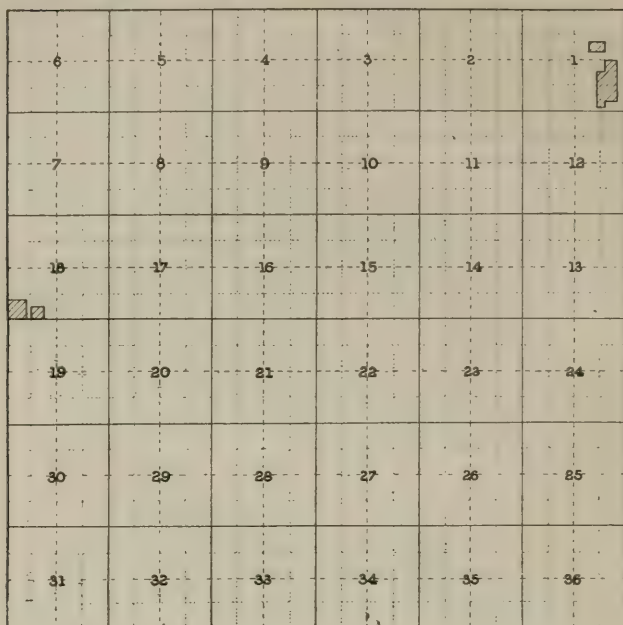
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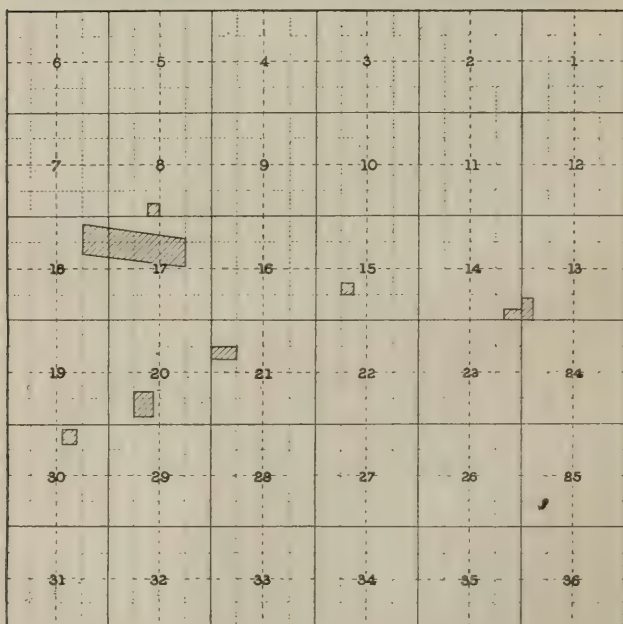
T. 4 N. R. 19 W. S. B. M. - VENTURA COUNTY.






## T. 4N. R. 20W. S.B. M. - VENTURA COUNTY.




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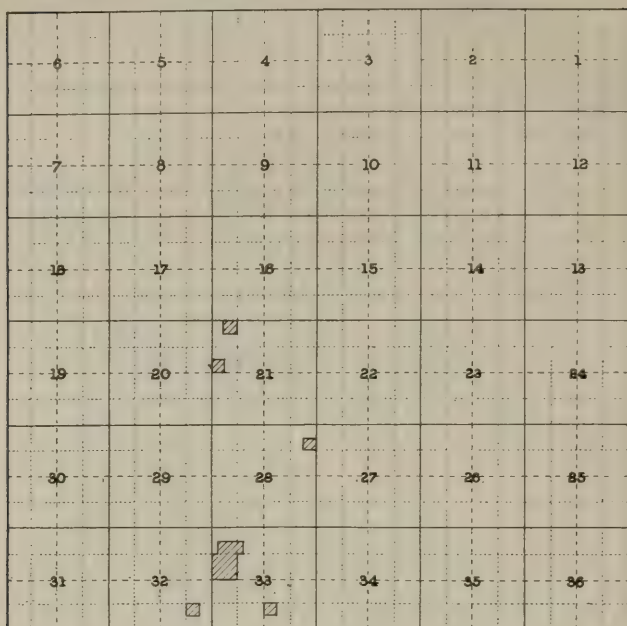
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30	29	28	27	26	25
					
31	32	33	34	35	36

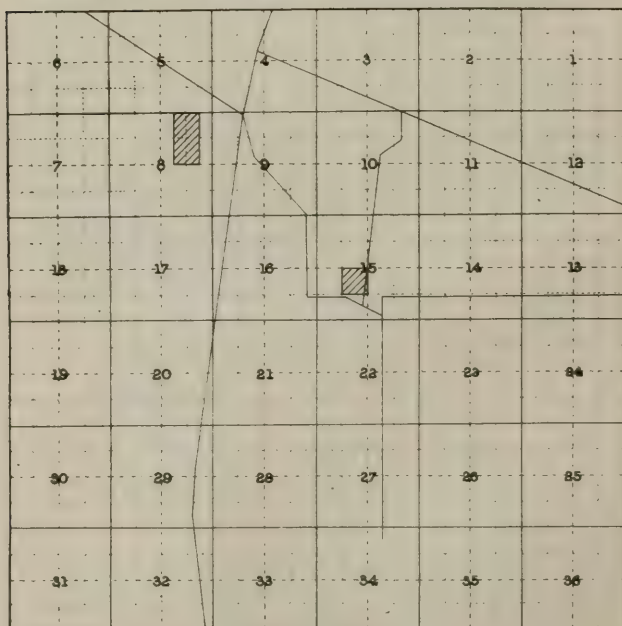
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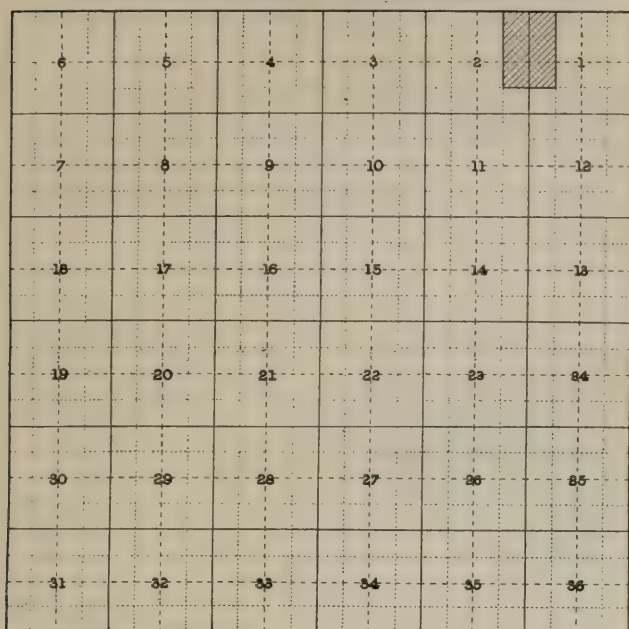
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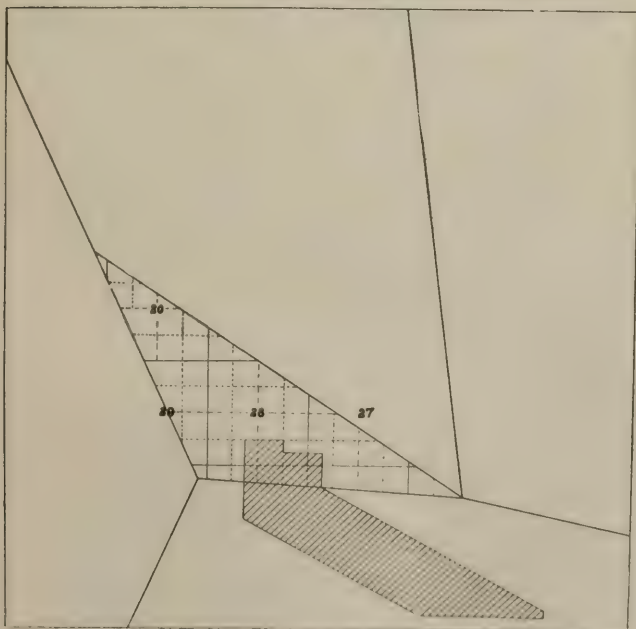
## T. 8N..R.32W. S.B. M. - SANTA BARBARA COUNTY.



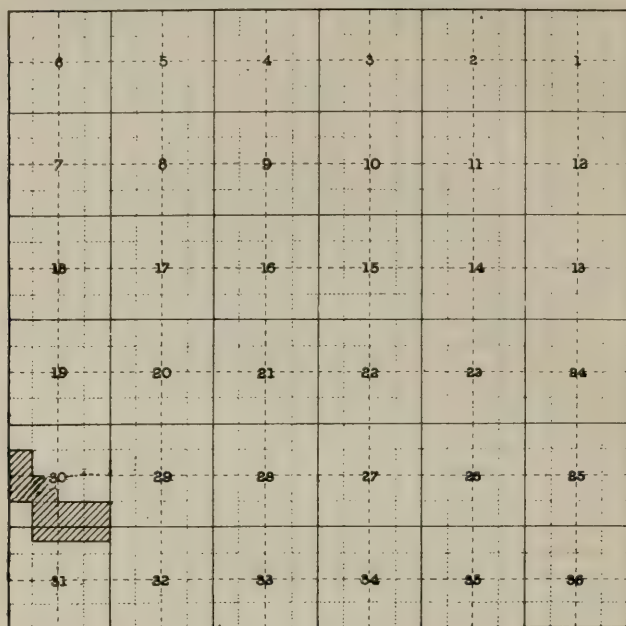
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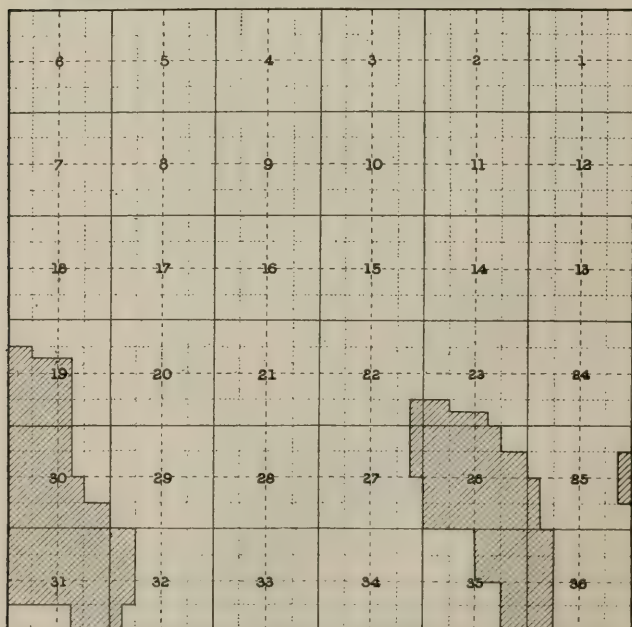
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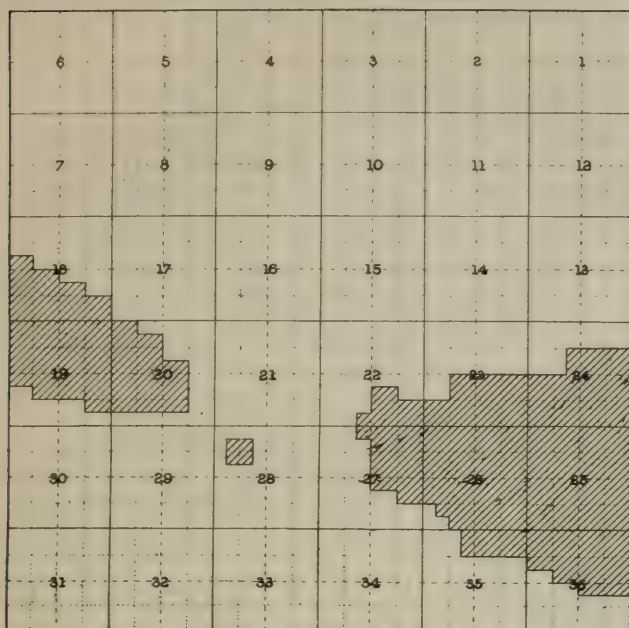
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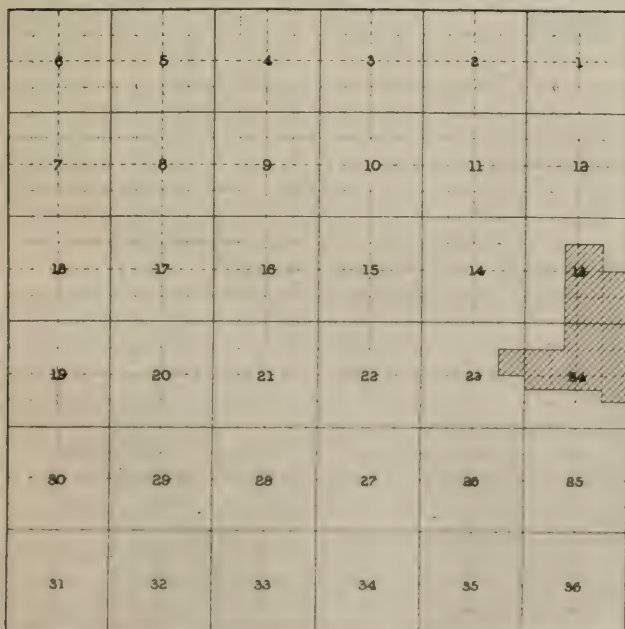
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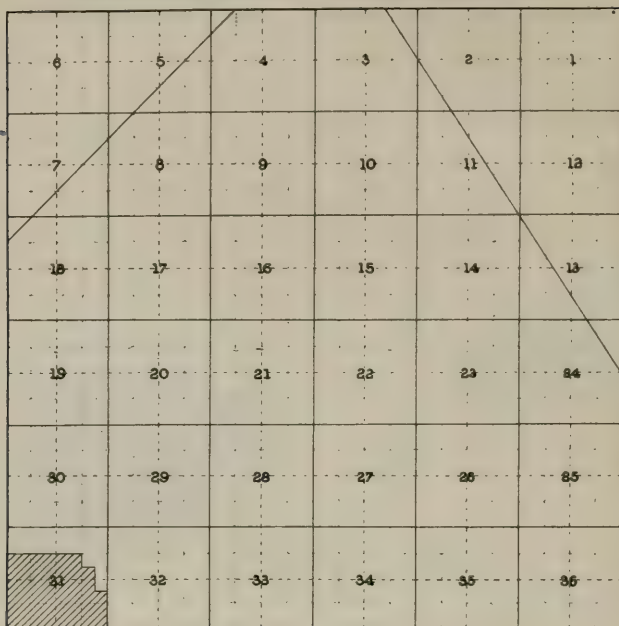
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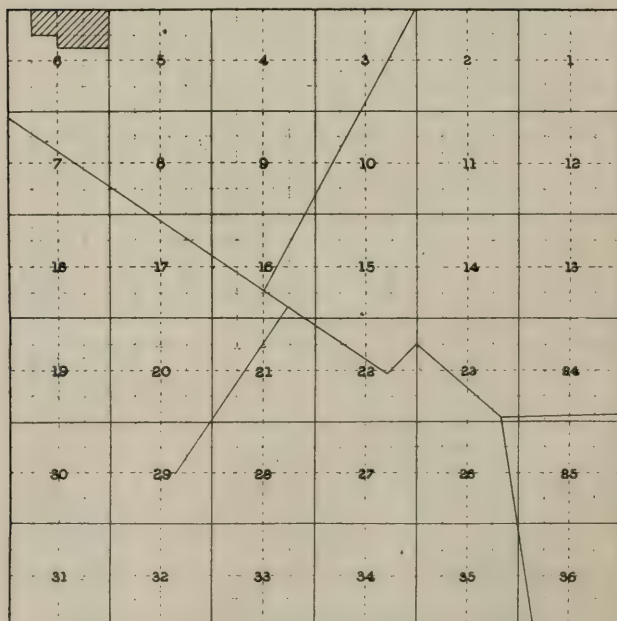
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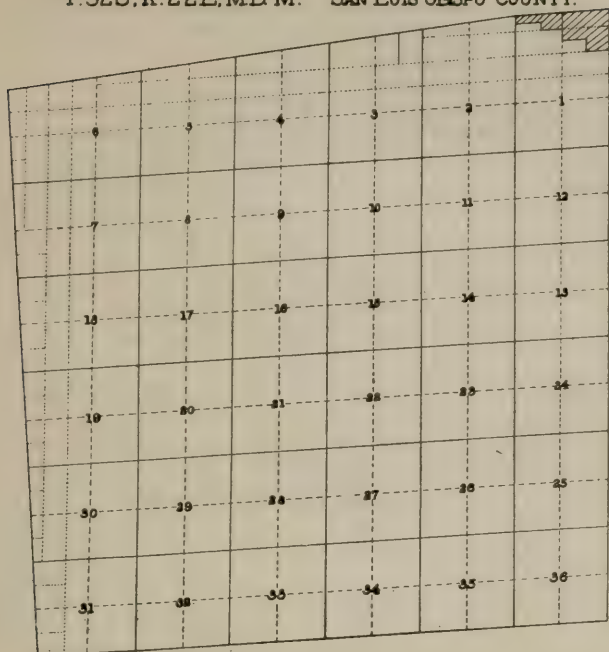
## T. 31S., R. 13E., M.D. M. - SAN LUIS OBISPO COUNTY.



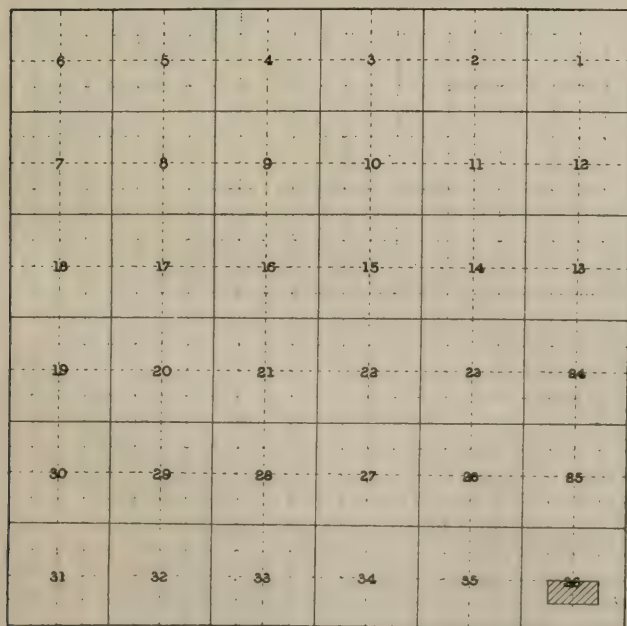
## T. 32S., R. 13E., M.D. M. - SAN LUIS OBISPO COUNTY.



T.32S.,R.22E.,MD.M. SAN LUIS OBISPO COUNTY.



T.11S.,R.3E.,MD.M. - SANTA CLARA COUNTY.



## T 11N. R. 23W. S.B.M. - KERN COUNTY.

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

## T 11N. R. 24W. S.B.M. - KERN COUNTY.

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



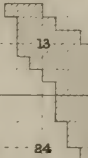
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19	20	21	22	23	24
29	28	27	26	25	
31	32	33	34	35	36



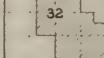
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16	17	16	15	14	13
19	20	21	22	23	24
29	28	27	26	25	
31	32	33	34	35	36

T. 26S., R. 20E., M.D.M. — KERN COUNTY

6	5	4	3 	2	1
7	8	9	10	11 	12
18	17	16	15	14	13 
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

T. 26S., R. 21E., M.D.M. — KERN COUNTY.

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19 	20	21	22	23	24
30 	29	28	27	26	25
31	32 	33	34	35	36

T. 27 S., R. 20 E., M. D. M. — KERN COUNTY.

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

T. 27 S., R. 21 E., M. D. M. — KERN COUNTY.

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

## T 28 S R 21 E. M.D.M - KERN COUNTY.

6	5	4	3	2	1
7	8	9	10	11	12
16	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

## T 28 S. R. 27 E. M.D.M - KERN COUNTY

6	5	4	3	2	1
7	8	9	10	11	12
16	17	16	15	14	13
19	20	21	22	23	24
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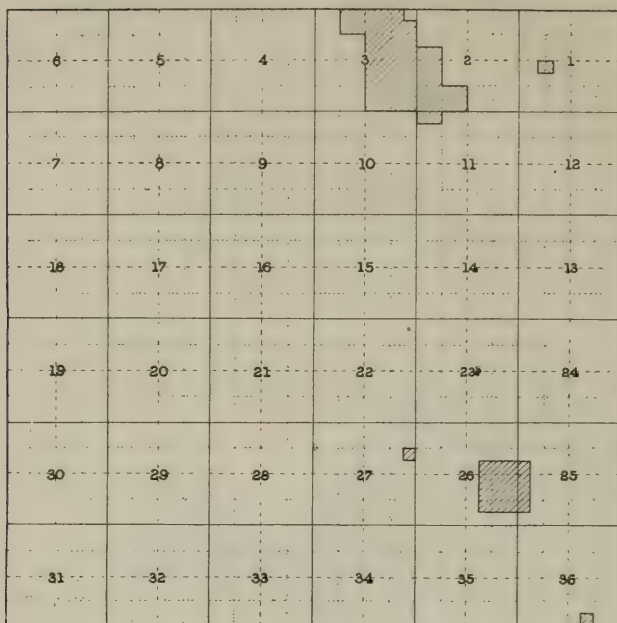
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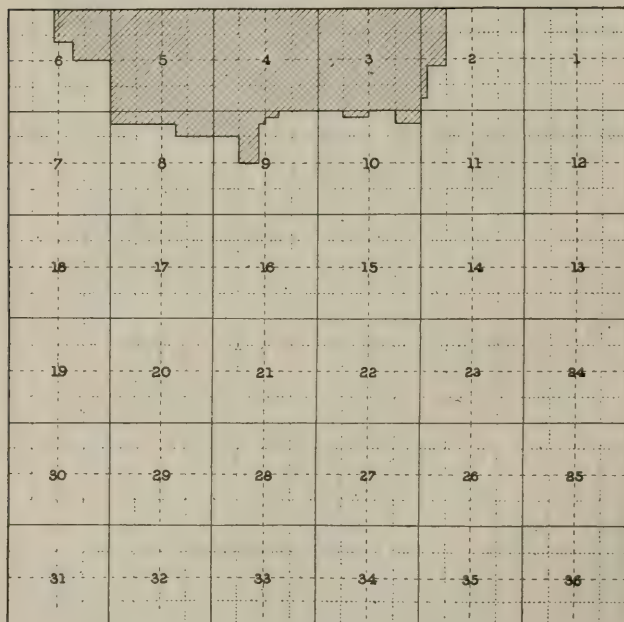
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18	17	16	15	14	13
19	20	21	22	23	24
20	29	28	27	26	25
31	32	33	34	35	36

## T.29 S., R.21 E., M.D. M. - KERN COUNTY.



## T.29 S., R.28 E., M.D. M. - KERN COUNTY.



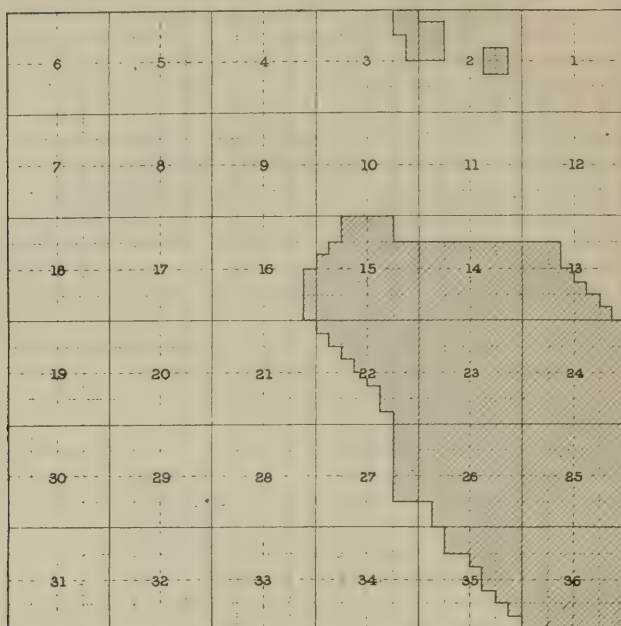
T.30S.,R.21E.,M.D.M. - KERN COUNTY.

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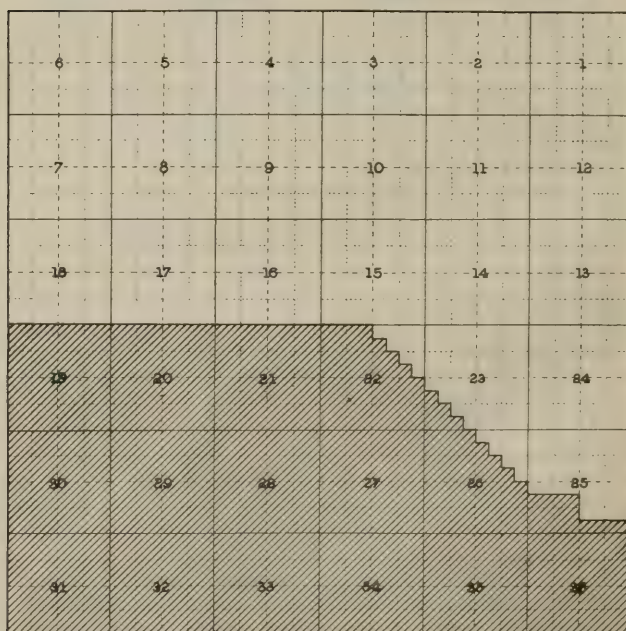
T.30S.,R.22E.,M.D.M. - KERN COUNTY.

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19	20	21	22	23	24
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31	32	33	34	35	36

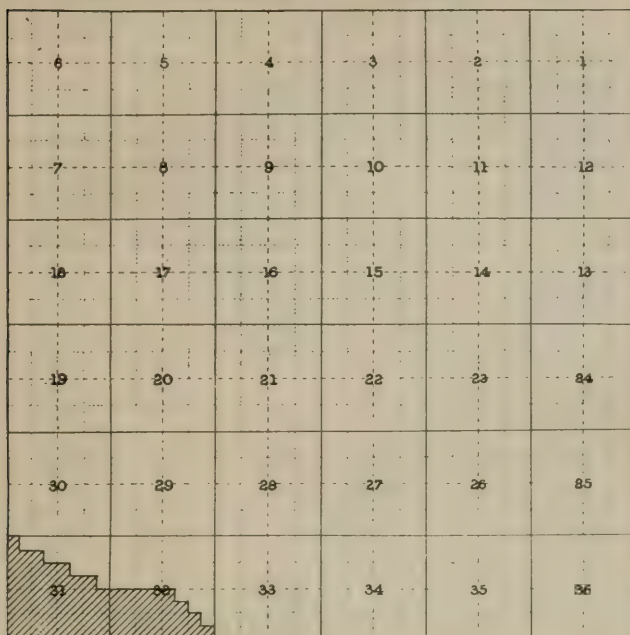
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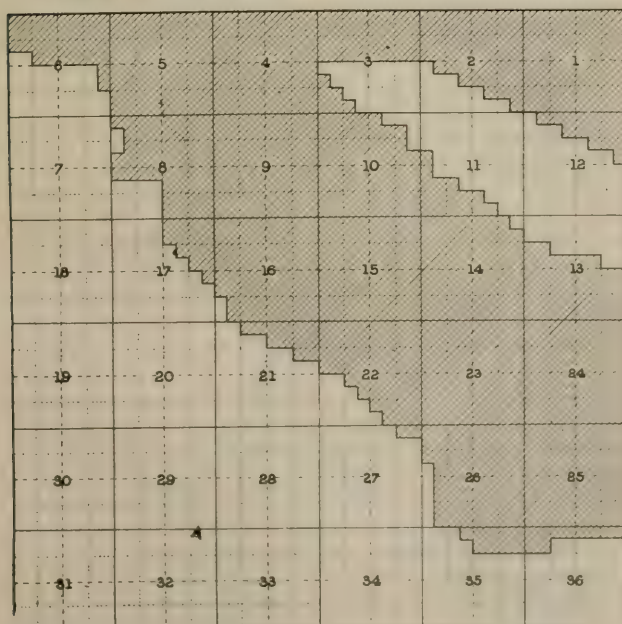
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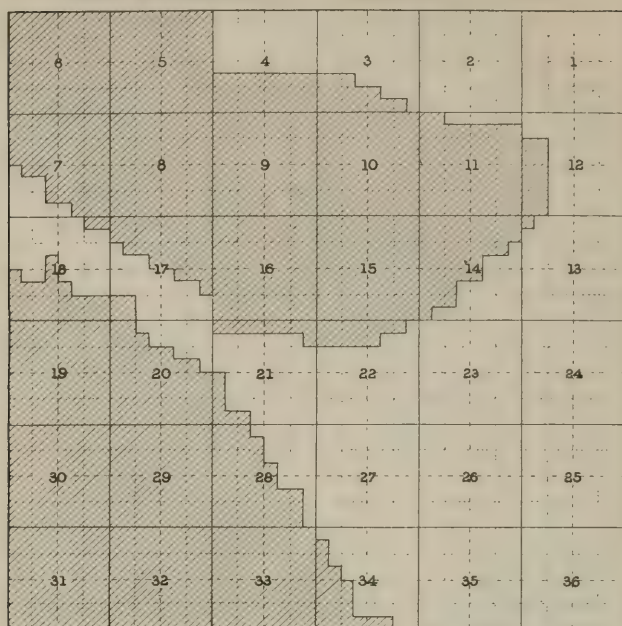
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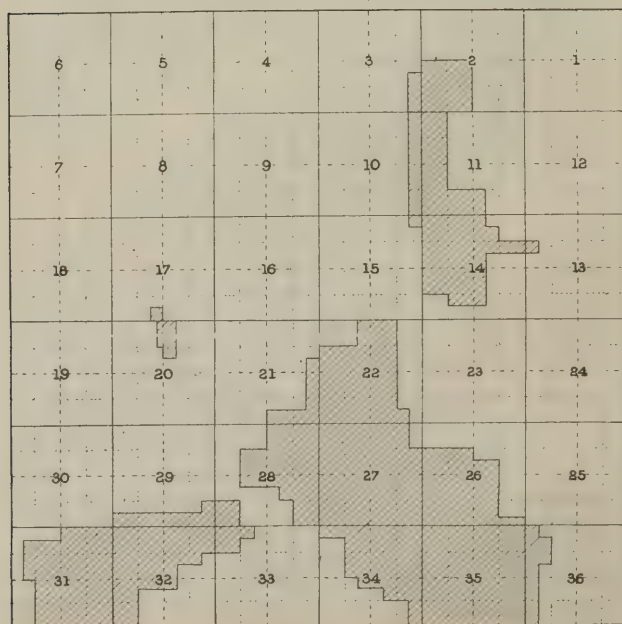
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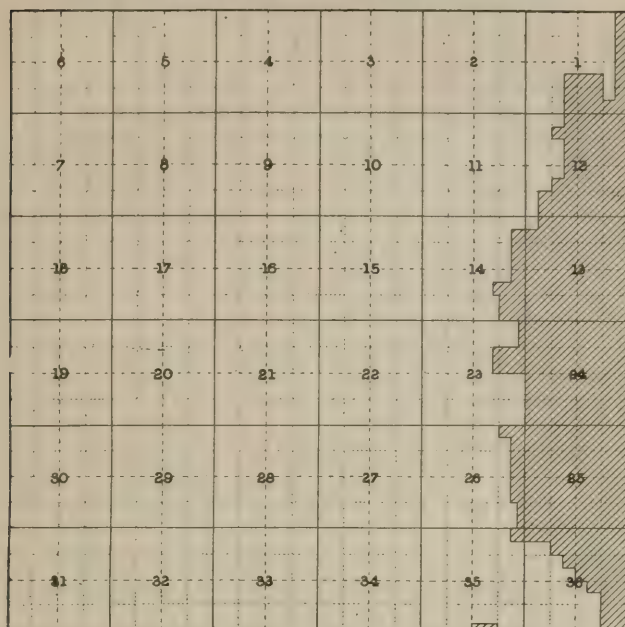
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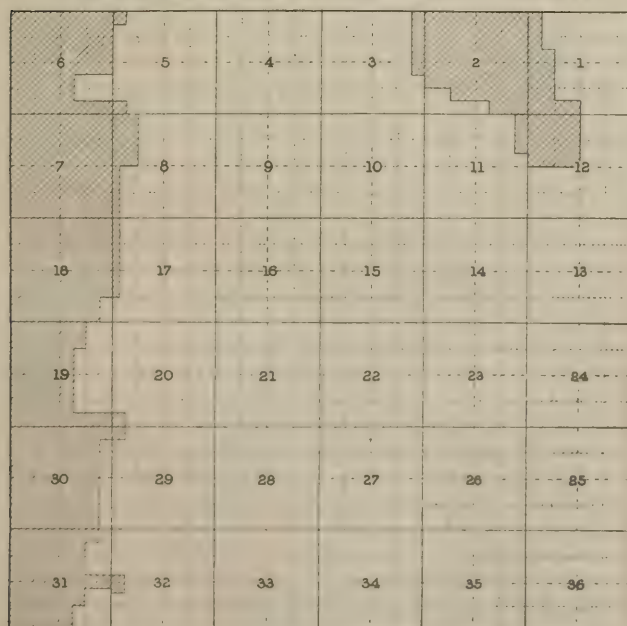
## T. 19 S. R. 15 E. M. D. M. - FRESNO COUNTY.



T. 20 S. R. 14 E., M.D. M. — FRESNO COUNTY.



T. 20 S. R. 15 E., M.D. M. — FRESNO COUNTY



## T.21S., R.14E., M.D.M. - FRESNO COUNTY.

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31	32	33	34	35	36

## T. 21S., R. 15E., M.D.M. - FRESNO COUNTY.

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19	20	21	22	23	24
26	29	28	27	26	25
31	32	33	34	35	36

The details of the work of the department throughout the state are set forth in the following tabulation:

# WORK OF DEPUTIES IN VARIOUS FIELDS.

Deputy, office address, and counties covered	Notices served on wells	Decisions			Aban- don	Total	Acres of proved land	Number of pro- ducing wells	Logs filed	Graphic logs	Per- muted acres
		New wells	Shut-off	Reopen or retail							
M. J. Kirwan, 512 Union League Building, Los Angeles, California. Los Angeles and Orange counties.....	138	179	256	75	37	547	5,818	1,068	1,243	1,173	10,880
Irving V. Augur, Limoneira Building, Santa Paula, California. Ventura County .....	40	43	71	34	24	1172	1,726	360	550	311	3,200
H. W. Bell, Valley Savings Bank Building, Santa Maria, Santa Barbara, San Luis Obispo, Monterey and Santa Clara counties.....	63	78	143	95	43	359	9,875	362	500	354	7,300
R. N. Ferguson, State Mining Bureau Building, Taft, California. Kern County .....	435	579	21,007	438	136	2,160	56,047	4,837	5,094	3,668	13,200
R. D. Bush, State Mining Bureau Building, Coalinga, California. Fresno, Kings and other counties.....	123	137	208	190	38	573	12,994	1,174	1,415	920	2,150
Totals .....	808	1,016	1,685	832	278	3,811	87,360	7,801	8,802	6,126	36,130

<sup>1</sup>Forty-nine reports covering supplementary notices not included.

<sup>2</sup>Includes 161 special tests.

By comparing the foregoing figures with those covering the previous year<sup>1</sup> the increase of routine field work and the advance in our engineering investigations are clearly seen.

The amount of routine work of the various kinds increased from 8 to 74 per cent due to increased activity in all the oil fields. The greatest increase is noted in the number of tests witnessed, which reflects the closer touch we have been able to maintain with actual field operations.

The progress of investigations, which must underlie all intelligent decisions, is indicated by the number of graphic logs and the total area covered by peg models. The number of producing wells for which graphic logs have been made is now 82 per cent as against 36 per cent for the previous year.

The acreage of proved land for which peg models have been completed is now 42 per cent as against 15 per cent last year.

### LOS ANGELES AND ORANGE COUNTIES.

Operations in Los Angeles and Orange counties have been followed with particular interest during the year because it is principally through the new production from the Montebello and Coyote Hills fields that an otherwise declining state production has been maintained. The report of M. J. Kirwan shows that the oil production of the two counties increased 28,236 barrels per day between June, 1917, and June, 1918. This increase, however, does not represent the total amount of oil contributed by the 76 wells completed during the year, because there was a decline of 11,060 barrels in the production of wells completed before June, 1917. The total average daily production contributed by wells completed during the fiscal year was, therefore, 39,296 barrels. This production came mostly from the Coyote Hills and Montebello fields. These new wells have more than doubled the production from all wells in the two counties.

Although there have been serious water conditions to deal with in recently developed areas, Mr. Kirwan's report shows that the wells completed during the year produced 5.5 per cent water, as compared with 21.6 per cent water for production from all wells completed prior to June, 1917. As shown in the report, three wells, in as many fields, contributed more than half the water for the new wells in those fields. Even including these three wells, for which no responsibility can be assumed by this department, a comparison of water percentages for the old and new production demonstrates the value of properly directed engineering work. Repair work has been started on two of these wells. The third well, situated in the Montebello field, is not only a menace to

<sup>1</sup>Bull. No. 82, Cal. State Min. Bur. p. 121.

this new field, but is a serious reflection against operating methods of one of the largest producers in the state.

The amount of work in the two counties, involved in recommendations and engineering advice to operators, has more than doubled during the past fiscal year. The department has been steadily engaged in the work of assembling all available data on past and present oil well operations as a ground work for future engineering problems and investigations. Graphic logs have been made of 94 per cent of all logs on file. Uniformly drawn graphic logs have been necessary in the construction of peg models for study of underground conditions. Peg models have now been constructed for most of the important areas in Los Angeles and Orange counties. Numerous operators have made use of the models in preparing estimates for drilling programs.

Mr. Kirwan's report shows that there were only two formal complaints filed during the year. One of these complaints was settled in accordance with specifications issued by this department. Settlement of the other complaint awaits developments at a well now drilling.

The Coyote Hills field added 28 new wells to the list of producers during the year. These wells show a high daily average of production and are free from water. A study of underground conditions, made by this department, shows that even the proved portion of the field has not been developed to the full extent of its possibilities. Mr. Kirwan's statement of the conditions under which Murphy-Coyote well No. 44 of the Standard Oil Company was drilled, in accordance with recommendations of this department, illustrates the benefits of engineering study and application. An oil-bearing zone, previously considered nonproductive, was developed. The production, in itself, should be sufficient to bring a profitable return on the investment.

Any operator can profitably afford to follow such methods in determining the nature and number of oil-bearing formations or zones which underlie his property. It is somewhat surprising, in view of the demonstration made at the well referred to, that the company has made no further effort to test the zone. Anything but the development and conservation of the resources of a property to the extent of its economic possibilities is a shortsighted policy on the part of any operator—large or small.

Thirteen wells were completed in the Olinda field during the fiscal year. Most of the development work was carried on by the Union Oil Company and Petroleum Development Company.

A change, by one company in this field, in the method of reporting water produced, shows that the method, quite common throughout the state, of reporting only water in suspension after free water is drained off, gives a statement short of the facts as to the water condition of the

well. Due to the pressure of work incident to the drilling and repair of wells, the matter of submitting accurate reports of water and oil produced has not received the attention that it should have received. In analyzing operations in any group of wells, it is just as essential to have accurate records of production as it is to have accurate logs. Large quantities of free water drained from tanks and sumps are frequently not included in the operator's statement of fluid produced by a well. As the work of assembling records and preparing engineering information on underground conditions approaches completion, more attention will be given to this important accounting phase of the work.

A study of underground conditions by engineers of the Petroleum Development Company in this field has already yielded a substantial increase in production and opened the way for further profitable development.

There were no important new developments in the Brea Cañon field during the year. Mr. Kirwan has indicated that there are two groups of wells in this field responsible for almost 90 per cent of the water produced in the entire field. The method of repairing one of the wells of the Birch Oil Company, according to specifications issued by this department, demonstrates the possibility of benefiting the general productive condition of the field through plugging off water and also perforating opposite oil sands heretofore excluded.

There was a small decrease in production in the Puente field during the year. The production shows only a small percentage of water.

A slight addition was made to the proved acreage in the Whittier field. Production records of this field, as to oil and water, show the necessity of certain repair work on old wells. It is also evident that a larger drilling campaign is necessary in order to maintain production.

The advantages of careful prospecting and testing by zones in this field, are pointed out by Mr. Kirwan, giving definite results obtained at a number of wells. His report on the Murphy-Whittier property of the Standard Oil Company gives a thorough analysis of operating conditions in the Whittier field. The report can well serve as a model for other engineers.

There are several productive zones in this field. In order to conserve casing, and at the same time protect upper zones, in deep wells, this department has recommended the use of mud-laden fluid. The use of mud, however, is prescribed for certain definite purposes. It is still necessary for some operators to familiarize themselves with details of the mechanical operations involved in the proper use of the mud-fluid method.

As already stated, the Montebello field has played a very important part, during the past year, in maintaining the production of the state.

In June, 1917, this field was producing 852 barrels of oil per day, and in June, 1918, the production had risen to 16,985 barrels per day. Nearly three-fourths of the present production is from wells of the Standard Oil Company, which drilled the first producing well in the field.

Present indications are that water is going to prove a serious obstacle in the development of the field. In view of the fact that this department has prepared a complete analysis of underground conditions from present available data, for the guidance of operators, it is obvious that the responsibility for the future of this field rests largely upon the operators themselves. The Standard Oil Company has an opportunity to demonstrate whether or not a large operating concern could efficiently protect the oil lands developed by it.

It has long been recognized that one of the most important factors in the protection of any field is stratigraphic uniformity in depths of shutting off water. The Montebello field is not an exception to this condition. Failure to determine accurately the position and productiveness of oil-bearing formations prevents the planning of these necessary uniform operations to control water and obtain maximum production. In view of these conditions, this department has recommended careful testing of formations during drilling.

The results as shown by the drill, and reported by the drillers, are the basis of all engineering study of underground conditions. Nearly nine thousand logs of oil wells on file with this department, the records of drillers' observations, bear sufficient witness to the degree of responsibility of the man who drills the well. In this connection the following testimony, given by certain drillers, with reference to their observations during the drilling of well No. 4, Baldwin, of the Red Star Petroleum Company, in the Montebello field, which, as stated by Mr. Kirwan in his report, was the subject of legal action, is deemed by this department as ample and sufficient evidence in the course pursued:

**STATEMENT OF H. J. SANBORN, MADE IN ROOM 515, UNION LEAGUE BUILDING, IN PRESENCE OF R. P. McLAUGHLIN AND M. J. KIRWAN, OF THE STATE MINING BUREAU, AND DEPUTY DISTRICT ATTORNEY GEORGE E. GLOVER, OTHERS PRESENT BEING J. M. SPRAGUE AND J. H. THOMPSON.**

J. A. CAMP, Reporter.

Questions by MR. GLOVER:

Q. What is your residence, Mr. Sanborn?

A. 4209½ Stephenson avenue, Los Angeles.

Q. What is your occupation, Mr. Sanborn?

A. Rotary driller.

- Q. What company are you working for?  
A. I am not working for anybody now. I have been working for the Red Star Petroleum.  
Q. How long have you been working for them?  
A. Four months and a half.  
Q. What particular well were you employed on?  
A. Red Star Number 4.  
Q. How long have you been working on that well?  
A. Twenty-five days.  
Q. Who is the foreman of that particular well?  
A. T. E. Lloyd.  
Q. Whose employ is he directly under—who does he get his orders from?  
A. I suppose he gets them from Davis.  
Q. You know Davis' initials?  
A. A. H.  
Q. What is his authority, that is, what capacity did Davis work in?  
A. Superintendent.  
Q. Who else was working on this well as the same time you were?  
A. Mr. Sprague and Mr. Thompson.  
Q. You know a man by the name of R. L. Peeler?  
A. Yes, sir.  
Q. What is his business?  
A. I am sure I don't know what capacity he does follow out there. They call the term out there "mud smeller."  
Q. Sometimes known as a scout?  
A. Yes, sir.  
Q. Was he on the job all the time while you were working there?  
A. No, he never came on the job. He never got out there.  
Q. You did not see or have any conversation with him?  
A. None whatever.  
Q. Who did you take your orders from?  
A. Mr. Lloyd.  
Q. Who keeps the log book there?  
A. The driller makes out his own report.  
Q. When were you instructed to make out those reports?  
A. After we left tour, or at the end of our tour.  
Q. In other words, when you got off shift?  
A. Yes, sir.  
Q. You wrote up your log book for any developments during the time you were on duty?  
A. Yes, sir.  
Q. What instructions, if any, did you receive in regard to making up the log book on this particular well? You receive any particular instructions any different for this well than for any others?  
A. He told me that morning he wanted that mud kept as heavy as possible, and he said that Kirwan wanted to save out samples every ten feet, but he did not tell me where or when to start.  
Q. Did he ever at any time tell you not to take samples?  
A. No, he did not tell me not to.  
Q. Never did instruct you at any time to take samples?  
A. No.

Q. Did he tell you why he wanted you to keep this mud thick?

A. He said to keep that mud heavy—he did not want any oil to show on the ditch whatever.

Q. You did not thicken the mud did you?

A. We were in shale digging, and the mud keeps getting heavier all the time unless you thin it.

Q. You did not thin it up then, or allowed it to run thick?

A. Yes, sir.

Q. How long did you work with that thick mud?

A. All the time.

Q. During what depth, about?

A. I think he told us to keep the mud thick from 1350 feet, or something like that.

Q. You kept the mud thick from that time on did you?

A. Yes, sir.

Q. How deep did you go in this well?

A. 1512, I think.

Q. Now, did you see any indications of oil during that distance?

A. I certainly did.

Q. Where did you first notice it?

A. About 1396.

Q. What kind of shale were you in at that time?

A. We were in sandy shale.

Q. You ever report that to Mr. Lloyd?

A. No, I did not.

Q. Did he ever say anything to you about any oil indications?

A. Yes, sir, he did.

Q. When was that? What particular depth, do you remember?

A. Along about 1350, I think he said.

Remark by MR. GLOVER: Now, MR. KIRWAN, I think if you will go ahead from here, if there are any points you particularly desire to bring out?

Questions by MR. KIRWAN:

Q. What evidence of oil did you have when you first noticed the oil?

A. Saw it around the ditch. The seum came up from the ditch when I first noticed it. That is the only way you can tell.

Q. When you pulled out the tools was there any sandy shale on the tools?

A. Yes, sir.

Q. Did that sandy shale have any evidence of oil in it?

A. I broke a piece open and oil sand inside of it. I laid it upon the bull wheels and Mr. Sprague saw it.

Q. How large a sample of oil sand was in that particular piece of shale?

A. I should think about as big as your thumb, and smelled strong, too.

Q. You actually saw the oil oozing out of the shale that you broke open?

A. I did.

Q. On the 24th you went off tour at a depth of about 1396 feet?

A. Yes, sir.

Q. And on the 25th you came on tour at a depth of about 1456, is that correct?

A. Yes, sir.

- Q. And you drilled to what depth?
- A. 1496.
- Q. During the drilling of the forty feet between these depths, did you notice or note any oil on the ditch or by the tools?
- A. It was showing up strong in the ditch, and gas.
- Q. Was there any shale brought up by the bit that showed any evidence of oil during the drilling between those depths?
- A. There was, because I pulled out, and I found a piece of shale on the bit that indicated oil.
- Q. That depth you pulled out was bottom, 1496?
- A. Yes, sir.
- Q. Did you save that sample of shale?
- A. I am not sure.
- Q. Did you ever save any samples of this well or turn them over to anybody that you remember of?
- A. No.
- Q. Who else worked on the well in addition to yourself, who were your helpers? What were their names?
- A. Jones, the derrick man; Henry Sinclair, Harry Wolf and Bob Johnson.
- Q. Did any of those men see the oil, so far as you know, coming from the well or the rotary bit?
- A. They noticed the same as I did.
- Q. Which one in particular?
- A. They all did.
- Q. Did any or all of them see the sample you obtained from the bit, at the depth of about 1396?
- A. Yes, sir.
- Q. Was there any discussion among the men as to the evidence of oil in this sample from the rotary bit?
- A. Well, I broke it open and showed it to them. I don't know whether any of them smelled it or not. I think Mr. Sinclair did.
- Q. Did they make any remarks to you whether it was a good showing or a poor showing?
- A. He thought it was a good showing on the bit.
- Q. Who in particular made that statement, and, if you remember, what statement did he make?
- A. I think Jones was out there, the derrick man, and he said he thought it a good showing of oil.
- Q. That was at a depth of about 1396?
- A. Yes, sir.
- Q. Were any of the officials of the company, such as Davis or Lloyd, present at this well at any time when oil was showing on the bit?
- A. I don't believe they were.
- By MR. GLOVER:
- Q. Any conversation between you and Mr. Lloyd that you do anything about the showing of oil, anything other than you have already stated?
- A. No.

Q. Now, Mr. Sanborn, in making out your reports, did you note these indications of oil that you found?

A. No.

Q. Why didn't you?

A. I didn't think we had to from the instructions we had about keeping the mud heavy.

Q. In other words, you understood, by reason of the fact that you had been instructed to make the mud heavy, that they did not want anything to show up on the log in regard to any oil at that depth?

A. Yes, sir.

Q. Was Mr. Lloyd always on tour while you were there?

A. Not always.

Q. In the event of his absence, did you ever get any orders from anyone else?

A. I can not say that I did. (Signed) H. J. SANBORN.

STATEMENT OF J. H. THOMPSON, MADE IN ROOM 515, UNION LEAGUE BUILDING, JULY 2, 1918, TO R. P. McLAUGHLIN AND M. J. KIRWAN, OF THE STATE MINING BUREAU, AND DEPUTY DISTRICT ATTORNEY GEORGE E. GLOVER, RE RED STAR PETROLEUM COMPANY WELL, RED STAR NO. 4.

J. A. CAMP, Reporter.

Q. By MR. GLOVER: What is your address?

A. 901 Doris street, Los Angeles, California.

Q. What is your occupation?

A. Rotary driller.

Q. By whom are you employed?

A. I was employed by the Red Star Petroleum Company.

Q. When did you quit working for them?

A. The 24th of June, 1918.

Q. What well were you working on at that time?

A. Red Star No. 4.

Q. Who else was working on the well at the same time?

A. Mr. Sanborn and Mr. Sprague.

Q. During your tour who was assisting you?

A. My helpers were Clayton Jordan, Frank Yaeger, Paul Robinson, and a fellow by the name of Charlie Jacobs.

Q. Who did you work under, who was your foreman?

A. Tom Lloyd.

Q. Did you receive any instructions directly from him?

A. Not always directly from him, no sir.

Q. In case he was not on your tour at any time, how did you get your orders?

A. I generally got my orders from the driller I relieved. He would leave word with this driller what he wanted me to do, or what action he wanted me to take and this driller would tell me.

Q. What driller did you always relieve?

A. I always relieved Mr. Sprague on this particular well.

Q. Did you ever get any instructions from Mr. Lloyd or Mr. Sprague in regard to making up the log or report on this well?

A. No, sir.

- Q. Did you ever see any indication of oil, say from the depth of 1396 feet on down?
- A. Yes, sir.
- Q. What were the indications?
- A. The indications were on the ditch as to oil floating on the surface of the ditch, on the top of the mud, oil and gas showing both.
- Q. Whose tour was it that this oil was first discovered on, if you know?
- A. I don't know what tour it was first discovered on—I think it was first discovered on Mr. Sanborn's tour.
- Q. When did you first learn that there had been any oil discovered by anyone?
- A. You mean what date, or what depth, or both?
- Q. What depth?
- A. As well as I remember, it was about 1456—that was the depth at the time I heard about the oil being seen on the night before. Mr. Sanborn told me about it.
- Q. You remember what he said to you at that time?
- A. He made the remark that he got a piece of shale off of the bit the previous night when he pulled out, and that there was quite a nice showing of oil seen in this shale.
- Q. Did you make any report in your log of this oil?
- A. I did not.
- Q. Why didn't you?
- A. I did not think such a report was wanted. Mr. Lloyd has always given me to understand that he did not want any oil showing, to show on the ditch, so I naturally supposed from that he did not want it to go in on the log.
- Q. You say he had given you to understand, what do you mean by that? What made you think he did not want any showing?
- A. He told me that he didn't.
- Q. What did he say?
- A. He said that he wanted me to carry the mud heavy and prevent any showing of oil or gas if we possibly could; that the water commission was watching that well pretty close, and they did not want it to show up at all.
- Q. You remember what date he told you this?
- A. I don't remember the date. It was when we were around 1300 or 1350, or something like that.
- Q. Therefore you never made any report of any oil or gas?
- A. No, sir.
- Q. Was Mr. Lloyd ever present when there was any showing of gas on the bit?
- A. Not on my particular tour, no.
- Q. Ever any discussion on your tour between you and your helpers as to any oil showing?
- A. There was on the next to the last tour that I run. Mr. Jordan went out on the ditch and discovered quite a showing of oil and gas, and in holding his hand on the ditch his hand would become covered with oil, and he would catch quite a few particles of oil sand in his hand.

- Q. Did he call your attention to that?
- A. Yes, sir.
- Q. What did he say?
- A. He came into the rig where I was and made the remark that we had a fine showing of oil there and he held his hand up and showed me where it was all covered with oil from dipping it into the ditch.
- Q. You made out a report of that run did you, after that?
- A. I made out a report of that run. I did not report the oil.
- Q. For the same reason that you have already stated?
- A. Yes, sir, because I did not suppose they cared to have any report of it.
- Q. Had you ever received any instructions from the company at any time, either directly or indirectly, not to report these showings?
- A. Well I had indirectly, yes, sir, not on this well, but on the former well that I worked on.
- Q. What well was that?
- A. The Tri-City well.
- Q. Who did you receive the instructions from at that time?
- A. E. L. Smith.
- Q. Who was E. L. Smith, and what authority did he have?
- A. I don't know that he had any authority, he was the driller that I relieved. He was drilling the tour from eight to four, and I asked him whether or not they reported oil and gas showings, and told him that I had had a slight showing of oil and gas on this well, and he said no, they did not generally report it, because they had got into several mix-ups by reporting it, and they did not do so now, making no report on the log. That is all the orders I had at any time as to whether to report them or not to report them.
- Q. And you were working for the same company at that time?
- A. No, that was the Pan-American Petroleum—it was under the same management.
- Q. You say that you are not in the employ of the company at the present time?
- A. No, sir.
- Q. When did you quit?
- A. Discharged on the 25th of June.
- Q. And why were you discharged?
- A. All the reason I could get for being discharged was because I had not taken any samples on this Red Star 4. I had never received any orders to take samples. Mr. Lloyd admitted as much to me.
- Q. You say "admitted"—that might be conclusive. What did he say?
- A. I don't know that I could say word for word. I asked him whether or not he had issued me any orders. He said no, he issued them to Harry and to Johnnie.
- Q. You never received any orders from Johnnie or Harry?
- A. The nearest to an order that I received, Mr. Sprague told me we were going to have to save samples every ten feet, but I do not recall that he said where or when.

- Q. Never told you at what particular point to commence taking them?
- A. Not to the best of my memory, no, sir.
- Q. When you say "Harry or Johnnie" who do you mean?
- A. Harry Sanborn and Johnnie Sprague.
- Q. You know R. L. Peeler?
- A. Yes, sir.
- Q. By whom was he employed?
- A. I guess he was employed by the same outfit that I was.
- Q. Did you see him at any time there at the well on your tour?
- A. Once, yes, sir.
- Q. When was that, do you know?
- A. I think it was in the neighborhood of 1400 feet. I don't know the exact depth.
- Q. Have any conversation with him in regard to any oil showing?
- A. I talked with him, but there was nothing said about the oil showing.
- Q. What was the conversation?
- A. I asked him whether or not they had discovered any oil in the Tri-City well.
- Q. What did he say?
- A. That they had not.
- Q. Did you ever have any instructions or orders to work in connection with him in regard to the oil?
- A. No, sir.
- Q. Or any indications that you found of oil there?
- A. No, sir.
- Q. What were his particular duties at the well, do you know?
- A. I don't know. My understanding was that he was supposed to be a geologist for this company. That was simply through hearing the other drillers talk. They called him the "mud smeller." I don't know what his official capacity was.
- Q. Did he ever at any time ask you in regard to any indications you found on this well?
- A. No, sir.
- Q. Now you were on tour at 1436?
- A. I went on tour when the well was that depth, yes, sir.
- Q. How far did you drill?
- A. Twenty feet, to 1455.
- Q. During that tour did you see any indications of oil?
- A. Why, yes, there were indications of oil in the last two tours that I run there.
- Q. What particular indications were there between 1436 and 1456, if you remember?
- A. The same indications that I formerly stated. Oil on the surface of the ditch and gas showing.
- Q. Did you have any instructions in regard to the thickness of the mud, how it was to run?
- A. Yes, sir.
- Q. Who did you get your instructions from in regard to that?
- A. Mr. Lloyd.

- Q. And what were his instructions?
- A. His instructions were for me to have the mud, he said to have that mud so thick I would have to help it around the ditch in order to keep that oil from showing on the ditch.
- Q. And you did keep the mud thick?
- A. I did for a while, and it was so thick I could not make any progress with the bit, so I thinned it up, and Mr. Lloyd the next day sent word through Mr. Sprague for me to keep the mud thick, not to thin it.
- Q. When you thickened the mud up, it retards drilling considerably, doesn't it?
- A. Yes, sir, it does, in shale digging it does.
- Q. And in following the orders received by you, therefore, you would considerably retard drilling operations?
- A. Yes, sir, in the particular digging I was in at the time, it would.
- Q. In drilling a well in shale of that nature, is there any necessity for making the mud thick in order to prevent caving, or anything of that kind?
- A. Absolutely not, it will make mud thicker than you can pump it out by digging in it.
- Q. Is there any necessity at any time in drilling to keep the mud thick in this particular well?
- A. Not from the depth that I took it on down, I found no occasion where it would be necessary. The well never showed any signs of doing anything but standing up to the best of shape all the time that I was on it.
- Q. What depth were you when you started drilling this well?
- A. As near as I remember, we were about 600 feet.
- Q. And the formation was such it would stand up in good shape from that on down, was it?
- A. Yes, sir, I did not pass through anything that would not stand up in good shape.
- Q. You never had any trouble with caving at any time, and no occasion to thicken the mud to prevent caving?
- A. No. I think as good proof as you could get is the fact that we twisted off before we thickened this mud and it sat there for 12 hours.
- Q. How deep was the hole then?
- A. As near as I remember it was in the neighborhood of 1000 feet, and if the well was caving at that time we would have had difficulty in pulling this pipe out after we got hold of it, after it sat there for twelve hours.
- Q. And the mud was running thin at this time?
- A. Yes, sir, the mud was in pretty good shape then.
- Q. Just what do you mean when you use the expression "twisted off."
- A. Just exactly what I said—the pipe twists in two.
- Q. When you were ordered by Mr. Lloyd to thicken the mud to prevent oil showing, was any reason given to you why the oil showing was undesirable?
- A. Yes, sir.
- Q. What was that reason?
- A. The reason he gave me was that the water commission was watching this well pretty closely, and they did not want the water

commission to see any oil showing on the ditch. They wanted it to go through this sand without having to stop there.

Q. You were discharged from this well on what date, Mr. Thompson?

A. The 25th.

Q. At what time?

A. Four o'clock in the afternoon.

Q. Who told you that you were discharged?

A. T. E. Lloyd. He did not tell me I was fired. I asked him whether I was fired, or what was the matter. He said no, I don't want to fire any of you boys for the simple fact that you might at some time want to work for this company again, either here in the United States or in Mexico, and he said that if the records showed that we were fired, it would be a difficult thing for us to obtain a position. "but" he says, "I advised the other two boys to quit, and told them where I thought they might get a job," and when I asked him what his idea was in letting us out he said it was because we had not saved out samples, and that he felt no other man could put us on any other well and get by with it. I asked him then if the water commission was running this *outfit*, and he said they were pretty near it.

Remark by Mr. McLAUGHLIN:

Q. He told you you were fired because you did not keep samples?

A. Yes, sir.

Q. Were you told by Mr. Lloyd that the state officers had been influential in having you discharged?

A. No, I can not say that I was told by him that you were. He left me, and I think the other boys, under that impression that it was through the state commission that we were going to be discharged. That was my understanding of it.

Remark by Mr. GLOVER:

Q. Had you seen anything of Mr. Kirwan or the commissioners the day you were fired?

A. No, sir, I asked to see them, they were at the office at the time, and I asked to see the commissioner who was the cause of it, and Mr. Lloyd said he was being made the goat of, and he was the man that was having to do the discharging.

Q. That is, you mean they were at the office of the Red Star Company at that time?

A. Yes, sir.

Q. But you did not have any conversation with the state officers at that time?

A. No, sir.

Q. Neither one of them ever send any word to you men while you were employed on the well?

A. No, sir.

Remarks by Mr. McLAUGHLIN:

Q. Did Mr. Lloyd ever tell you that the company had had any trouble at any other well with the state officers?

A. Yes, sir, he mentioned two other wells, if I remember right—I think one was the Darlington, and the other was the Prugh one.

- Q. Did he say on account of this former trouble the company was taking any particular steps in its dealings with the state officers at this particular well?
- A. Yes, sir, he said that the company was beating the case on one of these other wells—I forget which one he said—but that owing to the fact that the water commission was losing out in the other suit it would be particularly anxious to catch us up on this Red Star 4, and that was his reason for having the mud so thick that the oil would not show up, so to avoid you people being able to catch them up on this well.

(Signed) J. H. THOMPSON.

**STATEMENT OF J. M. SPRAGUE, MADE IN ROOM 515, UNION LEAGUE BUILDING, JULY 2, 1918, TO R. P. McLAUGHLIN AND M. J. KIRWAN, OF THE STATE MINING BUREAU, AND DEPUTY DISTRICT ATTORNEY GEORGE E. GLOVER, RE RED STAR NO. 4.**

J. A. CAMP, Reporter.

By MR. GLOVER:

- Q. What is your address?
- A. 3558 Sabina street, Los Angeles.
- Q. What is your occupation?
- A. I am like these fellows, I am not employed. I was a well driller.
- Q. Where were you last employed?
- A. Red Star Petroleum.
- Q. When did you quit working for that company?
- A. The 25th of June.
- Q. What well were you working on at the time?
- A. Red Star No. 4.
- Q. Who was your boss or foreman there?
- A. Tom Lloyd.
- Q. Were you employed on that well from the time it was started?
- A. Yes, sir.
- Q. At any time did you observe any indications of oil on any of your tours?
- A. I did.
- Q. When did you first observe that?
- A. I would have to look up that log. It must have been 1400 or 1410.
- Q. Where were you, at what depth then, when you first noticed the oil indications?
- A. It must have been between 1400 and 1410.
- Q. Who had you relieved at that time when you went on tour?
- A. Mr. Sanborn.
- Q. Anything said by Mr. Sanborn at that time in regard to oil showing?
- A. Nothing more than he told me there was gas showing up.
- Q. Mr. Sanborn stated to you that there was gas showing at that time?
- A. Yes, sir.
- Q. You remember any other conversation in regard to any oil or any gas?
- A. I don't believe I do.

Q. Did not receive any instructions from Mr. Lloyd in regard to making a report of oil or gas on this particular well?

A. No.

Q. Had you ever received any instructions from Mr. Lloyd or anyone else, that is, any other officers of the company, in regard to keeping a record of other wells that you had put down?

A. I had orders on Red Star No. 3 not to report oil showings.

Q. Who gave you those instructions?

A. Lloyd.

Remarks by MR. McLAUGHLIN: Is Red Star No. 3 in the same field as this well?

A. Yes, sir, same lease.

By MR. GLOVER:

How far, Mr. Sprague, is No. 3 and No. 4?

A. I don't know, about 2000 feet.

Q. What well had you worked on last, before you were working on No. 4?

A. I think it was the Hellman.

Q. What instructions did you receive from anyone in regard to reporting oil or gas showings?

A. We never did look for any there. Never expected any. Never did find any.

Q. Well now, what indications did you see of oil on this first tour of yours that you discovered oil?

A. It showed up on the ditch.

Q. What did you do in regard to it?

A. I never did anything in particular.

Q. Did you have any conversation with Lloyd in regard to it?

A. Well, he came into the rig one morning and saw this oil on the ditch and he says to me, 'It is showing up oil this morning,' and I says, 'Yes,' and then he had taken the boys out and had them dip it off the top with a bucket and throw it away.

Q. Who did that?

A. His name was Denver Crosby.

Q. You know where Denver Crosby is?

A. I think he is still working for the company.

Q. Now Mr. Lloyd did not give you any instructions at this time or any other time to take any samples?

A. No.

Q. What further instructions, if any, did Mr. Lloyd give you at that time in regard to this oil showing?

A. He had us pump more heavy mud into the well.

Q. What did he say in regard to pumping the mud in there?

A. He wanted to make it show heavy so that the oil would not show up any.

Q. Any further instructions in regard to skimming this oil off?

A. I had orders to keep it skimmed off.

Q. From Mr. Lloyd?

A. Yes, sir.

Q. Was it necessary to skim it off more than once during your tour?

A. If you wanted to dispose of it, it was.

- Q. Did you actually skim it or have it skimmed more than once while you were on your tour?
- A. Yes, sir, as much as three times.
- Q. Who did the skimming each time?
- A. I think two or three of them had a hand in it once.
- Q. And who were they?
- A. Lots of them fellows, I don't know their names.
- Q. Were any of them your helpers who helped you skim the oil off two or three times?
- A. Yes, sir.
- Q. Now, at any time while you were drilling there did you find the rotary broken down when you were on duty?
- A. I did.
- Q. At what depth?
- A. About 1400 feet.
- Q. Did you proceed to fix up the drill at that time?
- A. Yes, sir, after waiting on repairs, we got it fixed up about 2 o'clock.
- Q. Did you take the drill out immediately?
- A. The drill was out at the time.
- Q. Was there any unnecessary delay in fixing the tools to continue drilling?
- A. No more than waiting for repairs. I asked Lloyd about this gas showing—that was showing up that morning—and I says, 'If we go back and gas shows again, the water commissioners will be around—it is about time for them, and he said, 'I rather you would not get it started and have them see it.'
- Q. Then did you go ahead with it on your shifts?
- A. Yes, sir, then I got started to drilling.
- Q. But you did lay off for a time, did you not?
- A. Not any more than it would take to repair the rotary. There were no water commissioners there then.
- Q. When you say "water commissioners," whom do you refer to?
- A. The State Mining officials.
- Q. They are commonly referred to by the drillers as the water commissioners, are they?
- A. Yes, sir.
- Remark by MR. McLAUGHLIN:
- Q. Upon what date were you discharged, Mr. Sprague?
- A. The 25th of June.
- Q. Who told you that you were discharged?
- A. They didn't tell me I was discharged.
- Q. How did you come to quit?
- A. They told us to.
- Q. Who told you to?
- A. Tom Lloyd.
- Q. What reason did he give for telling you to quit work?
- A. He said they were having trouble because there were no samples saved.
- Q. Did he make any statement to you that the state officials had been influential in having you discharged?
- A. Not in my presence he didn't.

- Q. Did he make any statement indicating that he could no longer use your services at any well?
- A. I think he did, I don't remember what they were.
- Q. Did you receive your final pay?
- A. Yes, sir.
- Q. By whom were you told to get your pay?
- A. By Mr. Lloyd.
- By MR. GLOVER:
- Q. What did he say at that time, in regard to further employment?
- A. He advised us to look some place else for work.
- Q. At any time while you were working on this Red Star No. 4, did Mr. Lloyd or anyone else give you any instructions to keep any samples?
- A. Not that I remember of. Mr. Peeler did.
- Q. When was that?
- A. It was when we were about 1200 feet deep.
- Q. Did Mr. Peeler instruct you to take samples?
- A. No, he said that Kirwan wanted samples.
- Q. When did Mr. Peeler have this conversation with you?
- A. When we were about 1200 feet deep.
- Q. What conversation did you have with him in regard to taking samples at that time?
- A. He just said Mr. Kirwan wanted samples, and we could keep a sample there and send one in.
- Q. What position, if any, did Mr. Peeler hold with the company?
- A. I don't know. I suppose what they called 'Mud smeller.'
- Remarks by MR. McLAUGHLIN:
- Q. Were you ever informed by any official of the company as to the connection of Mr. Peeler with the company?
- A. No.
- Q. Were you ever instructed to take orders from Mr. Peeler?
- A. No.
- Q. Were you ever instructed to confer with Mr. Peeler about drilling operations or samples?
- A. Not that I remember of.
- Q. How many times during the drilling of this well have you seen Mr. Peeler at the well while you were on tour?
- A. Some days he would be around as much as three times. I should judge.
- Q. Ordinarily, would he come to the well every day?
- A. Most always.
- Q. Did he personally inspect the ditch?
- A. I could not say about that.
- Q. Did he personally question you every day about the formations you were passing through?
- A. Once in a while he would.
- Q. Did he do it every day?
- A. No.
- Q. Did he, in your presence, question anybody else on those points?
- A. Not that I know anything of.

JOHN SPRAGUE (Signed).

Mr. Kirwan's analysis of conditions in the Montebello field and history of development should have the careful study of all operators interested in the development of this field. He notes that, with few exceptions, water was shut off above the first oil-bearing formations penetrated.

#### VENTURA COUNTY.

Increased activity in this county and expectation of still further increase of oil production caused the department to establish an office at Santa Paula during the past year.

It will be noted that our preliminary engineering work has been carried well along towards completion, notwithstanding the fact that the fields are small and widely separated.

The county appears to offer further opportunities for new developments and the small size of the fields may specially attract small operators. Some of the fields, particularly Piru, Ojai, and Ventura, are producing water in such quantities as to reduce profits to the operators.

Developments in the field near the town of Ventura are extremely promising, but water conditions are a most serious obstacle. The department has had some difficulty in impressing the necessity for systematic work, and there are wells which now menace the field. However, the fact is now more generally recognized that the water absolutely must be controlled if the field is to become a profitable producer, and better work may be expected in the future. In this field the department has made a special effort to rely on advisory supervision on account of the fact but little is yet known of underground conditions.

The construction of peg models by the department has been responsible for the discovery of many underground conditions which were not previously known. This information has already been of immediate assistance to operators in several instances and will be of still greater value in the future. Descriptions of the various fields by Mr. Augur set forth some of these details which merit the careful attention of interested parties particularly on the Montebello dome.

The completion of shallow productive wells near the Ventura River, several miles west of Sulphur Mountain, is an example of the fact that old prospecting work has not fully developed the county, and that detailed geological studies will be profitable.

#### SANTA BARBARA AND SAN LUIS OBISPO COUNTIES.

The underlying engineering work for the Santa Maria, Casmalia, Cat Canyon, and Lompoc fields has reached far along towards the point where systematic repairs and development can proceed. About 80 per cent of the proved acreage is now covered by peg models.

When the department entered these fields three years ago it was found that, although the fields had been operating some ten years, practically no detailed and systematic study had been made of the underground conditions. In view of the fact that the major portion of the "old field" is under control of the Union Oil Company of California, and that water production is far above the limit found justifiable by other operators in the state, it would seem reasonable to expect that the company will soon adopt modern methods of coping with an unprofitable situation. The operators in the new Casmalia field have already started on such a course.

In general a hearty spirit of co-operation has maintained between the operators of these fields and the department.

It is worthy of note that large sums of money have been expended on wildcat operations which might reasonably have been avoided.

A substantial increase in production from the small Arroyo Grande field occurred during the year.

New operations in the Casmalia field are among the prominent features of the year's work. It will be seen, in Mr. Bell's detailed report, that water conditions are serious and that the department has taken active steps in guiding development and repair work which has recently been undertaken by the operators. Another year should show profitable results *providing* the operators continue systematic and co-operative efforts. This locality is an excellent example of the fact that even the latest and most approved mechanical methods of shutting off water avail but little unless guided by geological and engineering study. The detailed report on these conditions should prove valuable to progressive operators in other fields.

The Cat Canyon field progressed but little during the past year, and adverse water conditions were encountered. Recent developments in this locality are an example of results following scant use of geological and engineering knowledge. It will be noted that possibilities of future profitable development still exist.

The Lompoc field saw no new development during the past year, although there appears to be ample margin for new wells in the proved area. The field is controlled by the Union Oil Company of California. Water is not being properly excluded from the oil-bearing formations.

In the Santa Maria field proper, sometimes referred to as the "old field," important results have followed the drilling of the second zone of oil-bearing formations. The new second zone production is thus far free from water and geological conditions are so favorable that only reasonable care would seem necessary to preserve the present status. This is an important discovery in view of the fact that flooding of this zone at various other places led to the assumption that it was irreparably ruined.

New drilling into the third zone has developed the fact that an "intermediate" water-bearing formation exists. Previous failure to identify the nature and position of this water-bearing formation possibly accounts for much trouble developed in the past. Extreme care will be necessary in future work.

The Sargent field, in Santa Clara County, is the farthest north of all producing fields of the state. The field is small. One new well was drilled during the year.

#### KERN COUNTY.

The Kern County oil field operations constitute the major portion of the activities of the state. When the department entered these fields three years ago it found some of the most aggravated water troubles existing in California. It also found that little or no systematic and detailed study of underground conditions had ever been made.

The present report shows the degree to which the necessary fundamental investigations have been pursued. Graphic logs for about 75 per cent of the producing wells have been made, as against 26 per cent a year ago. Peg models now cover 23 per cent of the proved area as compared with 12 per cent last year.

But few completed reports on flooded areas have been made, as shown by Mr. Ferguson's report, due to the fact that we had to first gather all the underlying facts. The next year will undoubtedly furnish a number of completed reports with conclusions and recommendations for repairs and developments.

Routine field work increased in all branches except that due to new wells. The largest increase was in the witnessing of tests, which amounted to 60 per cent. Special tests to the number of 161 were witnessed. These tests cover such operations as plugging and mudding new wells and were witnessed for the purpose of affording the utmost security possible. It is probable that, even with this extra effort, many operations were completed in a manner not up to the best practice developed and proved in other localities. Pressure of work has prevented summarizing the results obtained from unusual operations such as mudding<sup>1</sup> and we are, therefore, not yet prepared to make definite statements as to the efficacy of the process.

In the case where the supervisor's order was reversed by the district commissioners (p. 413) subsequent developments indicate that the conclusions of the order were correct<sup>2</sup>. Aside from damage and loss, at the particular locality involved, it is hoped that this case will demonstrate that an operator's own interest will best be served by entrusting engineering problems to an engineering organization rather than to a legal staff.

<sup>1</sup>Bull. No. 82, Cal. State Min. Bur. p. 43.

<sup>2</sup>See note, p. 450, *post*.

The Sunset field presents some of the most complicated underground conditions existing in California. The field has in recent years also witnessed some of the most ill-advised development operations which will require extensive revision and repair.

The Belridge field has, during the past year, furnished an excellent example of the value of careful and systematic prospecting work.

While the Kern River field has not yet seen very extensive repairing of its extensive and widely known water troubles, it is worthy of special note that the largest operator has undertaken detailed engineering investigation. This department has continually urged such procedure.

In the Midway and McKittrick fields it will be noted, by Mr. Ferguson's report, that the number of complaints filed by the operators has fallen off. On the other hand, joint requests for investigation have been filed. As previously stated this department can not make recommendations until all the facts are assembled.

#### FRESNO COUNTY.

The operators in the Coalinga field were the first in the state to recognize the necessity of systematically drilling and repairing wells so as to avoid water trouble and secure the utmost production.<sup>1</sup>

The result of the early use of methods now followed and enlarged by this department is shown by the relatively small amount of water now handled. An understanding, on the part of the most of the Coalinga operators, of the value of engineering work, has made it possible for the department to readily co-operate with them in the manner referred to in Mr. Bush's report. It has also been possible to prove or disprove many assumptions as to underground conditions which are of general economic importance in planning the operations of any oil field.

The oil industry must look forward to the necessity of putting forth every effort to determine the existence of loss either of time, labor, or material, so that such loss can be reduced. It will be noted that our report covering the Coalinga field this year summarizes the amount of time lost due to idleness of completed wells. It is believed that no such figures have ever before been assembled and as the system may be perfected throughout the state, a basis of comparison may be established. In view of the fact that from 10 to 20 per cent of the possible pumping time is being lost it will be seen that the item is important.

The individual instances cited by Mr. Bush show that even in a field where systematic principles are extensively applied new problems are constantly arising for careful study and supervision.

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<sup>1</sup>Bull. No. 73, Cal. State Min. Bur. p. 30.

## **DEMONSTRATIONS OF USE OF MUD-LADEN FLUID IN OIL WELL OPERATIONS.**

On March 11, 1918, a meeting was held in Los Angeles, for the purpose of discussing the possibilities of the use of mud-laden fluid in oil well operations. The meeting was called by the California State Mining Bureau and was attended by representatives of the Mining Bureau and various California oil companies.

Mr. Fletcher Hamilton, State Mineralogist, presided at the meeting and announced the program. The following is a transcript of the proceedings:

MR. McLAUGHLIN, State Oil and Gas Supervisor: Gentlemen: As the announcement has been made, this meeting is particularly to discuss the possibilities of the use of mud. It is unnecessary to call to your attention at this time that casing is not the most plentiful thing in the world. This subject of using mud came to our attention shortly after the department was organized and we immediately took it up and made some investigations which your attention was called to in our first report. A number of operators, we thought, would see the possibilities of the thing. We were disappointed in that—in fact there has been only a few operators who have undertaken to carry on an experiment and an experiment of any kind must be carried on under conditions which we control so that you can draw conclusions when you got through. We proposed that a certain number of wells should be drilled in clean territory and then give time to see whether or not this mud shut off was effective. Now, we have been particularly fortunate in having the co-operation of the Shell Company in the Coalinga field, which has drilled some wells, and their geologist, Mr. Nolan, in conjunction with Mr. Bush, of this department, have summarized descriptions of this work and Mr. Nolan has kindly consented to read the results of that work. After he has read these results, the matter will be taken up for discussion.

## **DEMONSTRATED VALUE OF MUD FLUID IN PROTECTING OIL SANDS.**

By E. D. NOLAN, Shell Company of California.

By means of a test well in Section 27, T. 19 S., R. 15 E., of the East-side field at Coalinga, the Shell Company has proven thus far that rotary drilling effectively seals up oil and water sands.

In this portion of the field there are the usual top water sands with large volume and considerable head, then below them upper oil sands then an intermediate water and finally the rich lower oil sands.

In the past it had been necessary to cement a string of casing above the upper oil sands to exclude top water, then cement a second string

below the intermediate water and use a third string to drill into the oil sands.

The Shell Company wished to save this extra string of casing, and particularly to save the time necessary to land it. Under the oil conditions which have prevailed during the past year, the need of getting a well to producing as soon as possible is obvious.

A conference was held with the State Mining Bureau and the general scheme planned for drilling a test well.

The well known as No. 90, Section 27, was placed 150' up the dip from Well No. 78 which had been producing from the upper sands for some time. Water should appear in No. 78 in a short time if the rotary did not protect these upper oil sands.

Well No. 90 on 27 was spudded on September 10, 1917. Drilled to 1631' by the rotary and upper oil and water sands mudded while passing through them.

Mud was thickened when top of upper oil sands was reached.

Hole was mudded up as fast as it was drilled.

No additional head was put on the mud. The hydraulic head was sufficient.

Red mud was circulated for five days after drilling ceased. The hole took practically none during this period.

The 10" casing was then cemented at 1631' with 200 sacks.

The hole is a 15½" hole with 5' of 14" hole at bottom where the 10" casing is landed. The 200 sacks should therefore extend up the hole about 300' or above the top of the upper oil sand and is a further guarantee that the sands are protected.

Production of Well No. 78 before and during the period when Well No. 90 was drilling is as follows:

Month	Oil, bbls.	Water, bbls.	Water in suspension	Gravity
Prior to drilling No. 90—				
July .....	1,138	88	1.7	26.2
August .....	1,111	77	0.6	26.3
Drilling started on September 10th—				
September .....	1,017	101	0.2	26.3
October .....	1,043	95	0.5	26.4
November .....	1,035	77	*	26.2
December .....	1,046	83	"	27.0
January .....	974	70	*	27.0
February .....	988	51	*	27.1

\*Centrifuge tests unavailable.

Pumper reported that muddy water appeared in Well No. 78 during time Well No. 90 was drilling through upper oil sands. This report could not be verified to our satisfaction. The slight increase of water during September and October makes it seem likely that some mud-laden fluid did come through. The water did not increase and this proves the above method of drilling a complete success.

THE UNIVERSITY OF CHICAGO

12/1/19

TO THE PRESIDENT OF THE UNIVERSITY OF CHICAGO  
FROM THE FACULTY OF THE DIVISION OF THE PHYSICAL SCIENCES  
SUBJECT: A RESOLUTION OF THE FACULTY OF THE DIVISION OF THE PHYSICAL SCIENCES  
PASSED AT A MEETING OF THE FACULTY HELD ON DECEMBER 1, 1919

WHEREAS, the Faculty of the Division of the Physical Sciences, at its meeting on December 1, 1919, has considered the report of the Committee on the Faculty of the Division of the Physical Sciences, and has decided to adopt the following resolution:

Resolved, That the Faculty of the Division of the Physical Sciences, at its meeting on December 1, 1919, has decided to adopt the following resolution:

Resolved, That the Faculty of the Division of the Physical Sciences, at its meeting on December 1, 1919, has decided to adopt the following resolution:

U-8000-1000

MAP  
SHOWING  
LOCATION OF WELLS DRILLED WITH MUD-FLUID  
ON A PORTION OF  
SHELL CO.'S PROPERTY  
COALINGA, CAL.  
SCALE

0 100 200 300 400 500 600 700 800 900 1000 FT

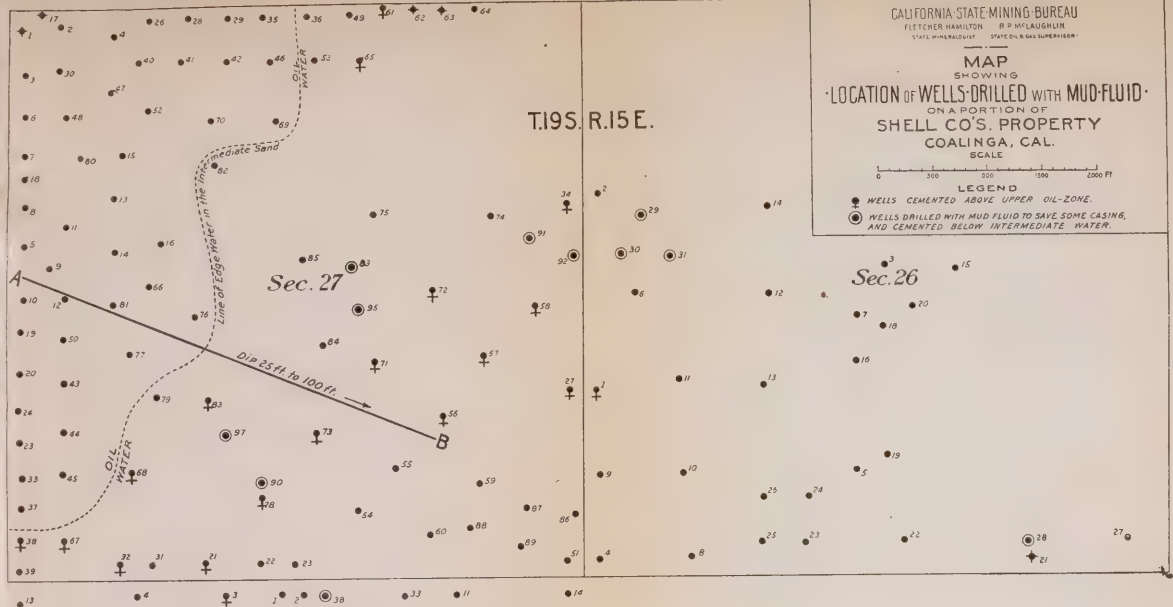
LEGEND

- WELLS CEMENTED ABOVE UPPER OIL-ZONE.
- ⊙ WELLS DRILLED WITH MUD-FLUID TO SAVE SOME CASING, AND CEMENTED BELOW INTERMEDIATE WATER.

T.19S. R.15E.

Sec. 27

Sec. 26



SECTION THRU A.-B.

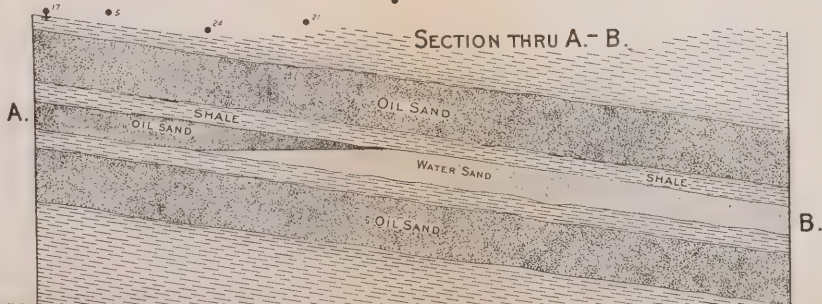


FIG. 3.

Since the completion of No. 90 on Section 27 the Shell Company has drilled a number of other wells by the same method and with the same object in view.

From these wells they deduced the following general conditions:

1. No conductor pipe is needed as it is not necessary to put on additional head over the hydraulic head of the fluid.
2. Hole is mudded almost instantly as rotary passes them. Fast drilling and rapid circulation are the means of accomplishing this.
3. Rapid rotation is conducive to effective mudding by contact with sides of hole and consequent tendency to force mud into the formations and by causing the solid particles to seek the side of the hole due to the centrifugal force.
4. We circulate the hole from one to three days after the proper depth has been reached. However, we have found that at this stage some holes will take no mud at all, some will take a little, and that none of them will take any mud after twenty-four hours.
5. Circulation can only be regained within three or four hours, and casing will freeze tight in this time. This we believe shows a distinct settlement and tendency of the mud to solidify.
6. The casing is cemented with 200 or more sacks by the Perkins process. This should force cement above the top of the highest oil sands.
7. Cement will set fairly hard even when mixed with 50 per cent mud and a mixture up to 30 per cent affects the strength very little. This we know from a number of laboratory tests. We therefore need have no fear of the cement not setting in a rotary hole.
8. A number of gravity and viscosity tests have been made on the drilling mud used on these wells.

The muds range from 5 to 10 per cent heavier than water. The 10 per cent mud is about as heavy as can be used for drilling.

The viscosity of the muds from blue clay of the above weights range from 2.3 to 3.5. These viscosities were obtained in a regular Engler viscosimeter.

Mud from red clay seems to have a lower viscosity for the same weight.

Centrifuge tests show the mud to range *2 to 4 per cent sand and 5 to 8 per cent solid clay*. These samples are taken from the mud pit after settling, when it is ready to be pumped back into the well.

Only a few samples have been taken of mud as it comes from the well, but these show considerably more sand; some as high as 13 per cent. These tests indicate that the settling canal does the work expected of it.

### CONCLUSIONS.

By R. D. BUSH, California State Mining Bureau.

Nine other wells in this vicinity, shown on the map with double circles, have since been drilled in the same manner, and the wells shown with a "cross," located to the east of the line of edge-water, are those which have been cemented *above* the upper oil zone and which are exposed to



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the infiltration of water at the mudded wells, should it develop that the work was improperly done. Of the wells cemented above the upper zone, some were drilled entirely through the lower zone and did not encounter the intermediate water, indicating that the water probably occurs in lenses of sand.

The character of the oil sands in this part of the field is such that water does not readily travel through them. The oil is comparatively light in gravity, about 20 degrees. The oil sands are hard and compact as shown in the drilling and by the fact that the wells produce very little sand, if any. Wells in this part of the Coalinga field have been known to stand or be in the process of redrilling or plugging with a large head of water on the oil sands for two and three years without affecting producing wells 300' and 400' away. For this reason it is the writer's opinion that it would be necessary to change the specifications of the mudding process used by the Shell Company in order to meet different conditions in other parts of the Coalinga field and in other fields of the state, where sands are more porous, or there is artesian water, or high pressure oil and gas to contend with.

MR. NOLAN: I might say, in this connection, that the Shell Company has recently abandoned two different wells by the mudding process in this portion of the field and another one, No. 14 in Section 14, which is in the north end of the east-side field. This well, No. 14, took a great amount of mud, over 40 tons and all under pressure of less than 200 lbs., in 30 ft. sand, and, in fact, mud appeared in a well 400 ft. away in three days after mud was forced in; although under practically nothing but the hydraulic pressure of the mud. This shows that the sand up there is certainly very porous. On the other hand, Well No. 62, Sec. 27, abandoned in this portion of the field in 500' of sand and shale, after the well produced for about 5 or 6 years, took a very small amount of mud, although the pressure went up to about 200 lbs. This would certainly seem to check up the investigations made by the State Mining Bureau..

MR. McLAUGHLIN: Gentlemen: That sums up the facts of the case. In order to forestall any misunderstanding, I want to particularly call attention to the fact that the conditions in that part of the state are not exactly the same as they are in some other portions even of the Coalinga field and that that is a demonstration of the success in one particular locality. The idea of the meeting is to have a discussion of these papers as we go along and anyone who has any question to ask of Mr. Nolan or Mr. Bush, may do so.

MR. POLLARD: It seems to me that the first thing we ought to discuss and ascertain and have everybody understand, would be the action of the mud-fluid in a well. For the first time since I have been handling the

mud-fluid for the purpose described here this morning, have I ever heard as clear and concise an idea of what the mud-fluid did in a well as Mr. Nolan of the Shell Company read this morning, but yet I feel that the majority of the drillers and operators are still in the dark as to the real action of the mud-fluid in the ground, and I know, through having had experience in traveling over the entire United States and in the employ of the Federal Government, that it is not understood, and I believe that, as a starting point and to get the men to understand where we are, we ought to first of all discuss what the action of the fluid is in the ground. This, as I say, has been somewhat clear in the paper just read, but yet it is not clear to those who have not made a deep study of this question, and it is one of the most vital questions that there is, in my opinion, in the petroleum industry, and I feel I would like some of the bureau men to tell us what their opinion is as to the action of the mud-fluid in certain territory toward the walling up and the prohibiting of one formation contaminating and mixing with the other, and I believe that a discussion along that line, first of all, would enable us to get a clearer and more concise idea of what we have met here for this morning.

MR. McLAUGHLIN: I think that these suggestions of Mr. Pollard's are very apt. I will put forth some idea of the elementary principles of this and I hope Mr. Pollard will correct me on any point. The theory of the mud-laden fluid is that the water is carrying in suspension fine mud entirely free from sand. Filters in cyanide plants at gold mines, for instance, are of canvas, and there is a vacuum created on one side which causes the liquids to go through the canvas and strains the slime out and deposits it on the canvas. When this cake is built up to the extent of about three-quarters of an inch, the filter becomes impervious and they have to clean that canvas off by reversing the current of air and blow the slime off. It is reasonable to assume that, when mud or mud-laden fluid, slime, is passing through a sand, whether it is a water or oil bearing sand or anything that has an opening, that the clay will be deposited the same as it is under all conditions that we have observed; therefore, the clay would be forced out from a well to a considerable distance, sometimes greater, sometimes less. Now it is well to bear in mind that it is a different action that you will have when mudding up a well with a rotary. Now bearing in mind how a filter is actually observed to close, I think you will get a conception of what the mud-laden fluid is. I would like to have Mr. Pollard expand on these remarks, if that answers the question, at all, that you have in mind, Mr. Pollard.

MR. POLLARD: It answers it in a way, Mr. McLaughlin, but still I don't believe it goes deep enough yet. I don't believe that the thing has been thoroughly thrashed out so we can know what to expect. In order for the meeting to get the idea, and the younger ones coming in, they may

come to a point where they could throw more light on it than us older men who have had the thing in charge. I feel I would like to get to the blackboard and just give a little sketch as to what happens. Lots of times the men will say, "How do you know?" There are certain things we do know while there are some things we do not know. The action of the mud-laden fluid is of such a character now that we know more about it than at any other time. I have studied the action of the mud fluid for 12 years in America and Europe. I believe that one of the most important things that we have in the business is the action of the mud-fluid, and if it is the wish of the meeting I would be pleased to draw a little sketch and show my idea of its action and just what happens.

MR. McLAUGHLIN: Just take the board, Mr. Pollard, I would be glad to have you.

MR. POLLARD: The filtering process that Mr. McLaughlin spoke of is a very good one. It is one that I use myself and use it all the time, but it does not explain all of what happens in a well. We have to take into consideration, with the filtering process, the pressure on the sands that we are treating, and the pressure has more to do with it than the filtering effect; and so that, in order to get a clear conception of that principle, I will take you back to the time when we used to test our boilers with the cold water test. We will take a boiler with a  $\frac{3}{8}$ -inch sheet or even greater. We will fill that boiler with cold water, then we would take a low-down pump, and pump more water into that boiler until it had obtained a pressure of three to four hundred pounds. When the pressure was on we would look around and tap the boiler with a hammer until the water would stand on the outside of the boiler in drops as big as your thumb-nail, forced through the boiler sheet by pump pressure.

Now, that is a serious proposition in a well. We are dealing with a pressure of a 1000 to 1500 pounds to the square inch. What will that do under those conditions in the ground? Many drillers and operators are of the opinion that the mud-fluid simply walls up the face of a well. I have read from supposedly noted petroleum engineers that the walling up of a well consists of putting mud-fluid into the well and the drillings in returning to the surface are plastered up on the side of the well with the mud-fluid, caused by the wobbling of the drill stem, no mention being made of the penetrating effect of the mud-fluid back into the formation. This penetrating effect that I speak of, is one of the most important in excluding water or gas, sealing it into its own formation. It is this same penetrating effect of the mud-fluid that becomes dangerous and sometimes is detrimental, inasmuch as it will load up an oil or gas sand in a manner that will spoil the production of wells adjacent to the well that is being treated. I have had analyzed some of the rock from the west side where the mud-fluid has been in the well, and we have found that the high pressure employed, combating the gas pressure had really

driven the mud-fluid into the rock, and you could obtain a tremendous amount of the fluid congealed and right into the pores of the hard shell, showing that the pressure was something enormous. I am satisfied that the pressure we put up with the pump did the work. Now then, if the well was 2000 or 3000 ft. deep and we add a pump pressure of 500 lbs. or even greater, it is equal to deepening the well so much more in depth. In order to get a conception of that we will just draw a few formations here (pointing to the blackboard and diagram thereon) this representing the stratified conditions of the ground drilled through. This is a shale; this is rock, and this is sand, and so on down. Now then, when the well has gone through these formations and the mud pressure is on, regardless of what the specific gravity or what the fluid is, there must necessarily be an outlet of the fluid. In representing that, we would say that the outside edge of the fluid as it penetrates into the formation would be in this shape, (see Fig. 4). Shale we know would not take as much fluid as sand would, and rock would be less impervious, hence would not take much fluid, so that in treating a section through the formation under discussion we would draw a line more or less (illustrating on the blackboard) in this manner. In some parts of the well the formation could be represented as back from the bore hole fifty to seventy-five feet, and in some cases even greater, so that we have an irregular line (as described on the blackboard) which would give some idea as to the filtering effect of the mud-fluid in the various formations.

Now then, we have conditions where I have pumped as much as three earloads of mud into a well. When I started this in the California fields I was laughed at and called a crank for using mud in this way. However, in sixty days after I did this I could see two or three earloads of mud come down from San Francisco Bay for other people who could not obtain results, which shows me conclusively that the men who are using the mud-fluid described in the last paper were not particular enough. It is an impossibility to expect the fluid to penetrate the sand you are dealing with and shut off gas and water, with so much sand in it, as described in the last paper.

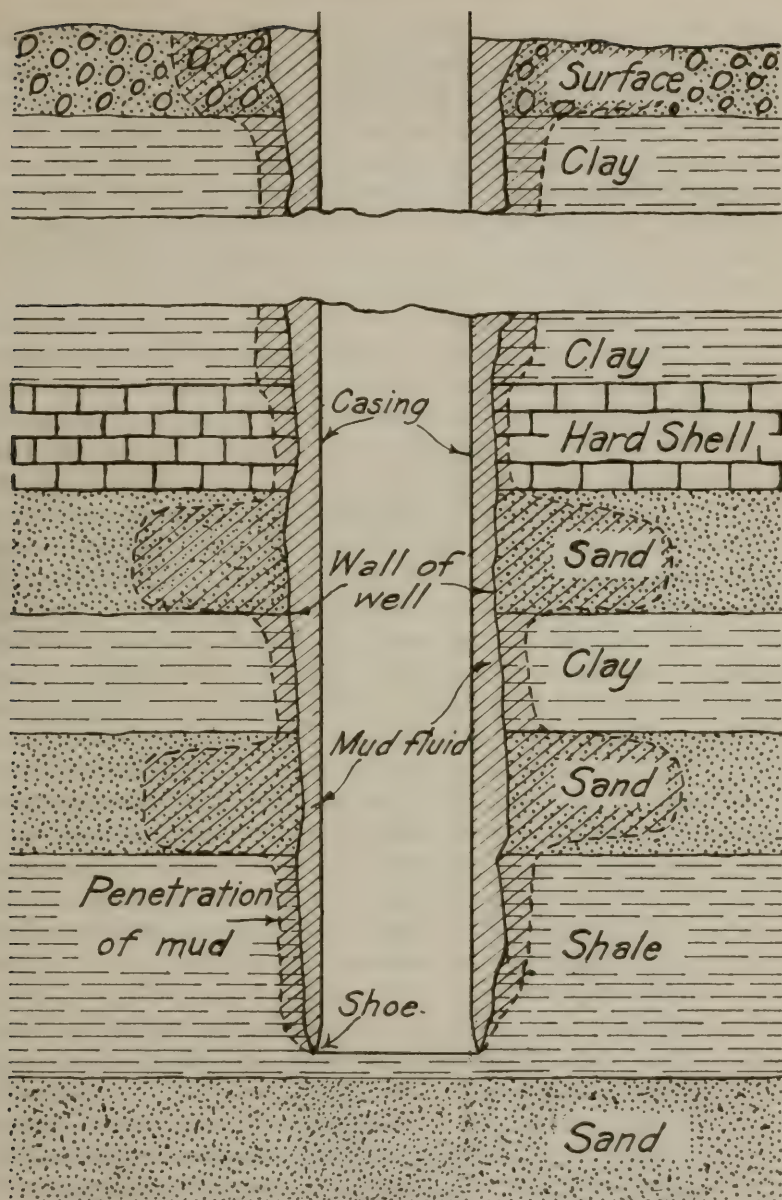
Since we know that the mud-fluid will travel, as it does in sands,—and we know it by the wells that have been stopped pumping by the fact of an adjacent well having been treated with the mud-fluid system—it behooves us to know just what the action is because if we let the indiscriminate use of this mud system go on, we are going to spoil this territory and undo all the good that the government expected us to do and lose the production of the field which we see is opening, so that the situation we have is one of the biggest things we have ever been up against before in our lives. If we attempt to save too much pipe we are going to undo the good that the government wants us to do. It is one of the most

serious things we have to contend with, and we had far better use some pipe than to undo any of the good. The conditions that prevail in California are different from anything else that we have ever had. We have conditions in the Midway fields, California, which should be treated differently from anything else, especially when we consider the cost of drilling a well and the value of the territory.

MR. McLAUGHLIN: I want to thank Mr. Pollard for his remarks, and I want to say that I agree with him that we can not at present issue a blanket approval of mud-laden fluid in all cases. If anybody else has any remarks, I would be very glad to hear them.

MR. I. W. FUQUA: Mr. Chairman, in connection with the problem of mud-laden fluid, it has always seemed to me to be, strictly speaking, the most scientific way of mudding off either water, gas, or oil-bearing formations that are apparently beyond the hopes of satisfactorily cementing off, through and by use of the regular methods of applying a cement for the purpose of excluding water from formations containing oil, and we have two instances in the Coalinga field, which have proven conclusively and to our entire satisfaction that mud-laden fluid can be made, if properly handled and mixed, and applied, to accomplish almost any desired results, and while our work can not be commented upon as being first class in character, nevertheless our intentions were good and we did the best we could under the circumstances, and believe that in a great many of the most serious and the most difficult of jobs, they could be handled most satisfactorily if the consistency of the mud is carefully prepared, forced in under whatever pressure that may be desired, and continue the process as long as it may be necessary, and I believe that greater results can be accomplished than have heretofore been effected, and prevent in a good many cases the shooting off of casing in a horizon or zone where a condition of this kind would only complicate matters and prevent the final completion and accomplishment of the task that was at first undertaken.

Our Well No. 8, Section 19-20-15, we were satisfied was more or less of a trouble maker in the way of allowing water to pass down from behind the one-time cemented casing and into the oil sand, and into other wells to the south, which were being considerably interfered with in their production of oil. In this well we had a great deal of casing trouble. As a matter of fact, it was in bad shape, and after considering the matter from every angle we decided that the mudding process would be the most logical solution of our difficulty. Mud was pumped in of various consistencies and under various pressures, from running it into the hole up to 200 pounds per square inch. This process was continued until such time as the well refused to take any more fluid, and immediately thereafter we observed an appreciable decline in the amount of water and a perceptible increase in the production of oil in adjoining wells



Sketch Showing  
 PENETRATION OF MUD FLUID  
 in various formations

By  
 JOHN A. POLLARD

FIG. 4.

to the south. Roughly speaking, in Well No. 7, which was approximately 350 feet south, in May, 1917, the oil production was only three barrels per day, the water running from 90 per cent to 98 per cent. The mudding off of Well No. 8 was completed in the month of July, 1917, and in August Well No. 7 came up in its production of oil to 20 barrels per day, and in December to 22 barrels per day, and in January and February this year 22 and 30 barrels per day, respectively, with an appreciable decline in water. Well No. 6, which was the next one south of Well No. 7, showed a decline in oil from 40 to 45 barrels to 12 barrels during the period when we believed that water was infiltrating into the oil sands in Well No. 8, and in September, 1917, Well No. 6 had increased its production to 20 barrels of oil per day with an appreciable decline in water, and in October the production in oil had risen to 28 barrels. In January this year the well produced 36 barrels of oil per day with a considerable decline in water, and we have reason to believe that there will still be a further decline in the production of water and perhaps a little further increase in oil. The oil sands, however, in this part of the district having been produced from for a number of years, there is not and never will be very much of an increased production. The main point will be to preserve the developed channels, through which the oil has been traveling to the various wells for a number of years, as much as possible so that the flow of the oil to the wells will not be interrupted by foreign substances of any kind, and to prevent, wherever it is possible to do so, the admittance and infiltration of water into the productive oil sands. I am advised that in some of the Eastern fields water is being run into oil-bearing formations for the purpose of chasing out the oil, and I understand that it is highly successful, but I do not believe that we will ever find it necessary to resort to this principle in this particular district in the Coalinga field. I think and believe that plenty of water will get in without having to intentionally break it in.

We have another Well No. 34 on Section 6-20-15, which gave us a great deal of concern and required a great deal of thought and effort before we were able to determine the exact source of the water, which was found later on to be a bottom water. Before this determination was made, however, a plug was placed below the cemented casing and the well was bailed dry, which indicated immediately that the water was coming from some other source, and in continuing our efforts it was finally decided and located in the bottom, after which we mudded up thoroughly and put in a cement bridge on top. The well was making, before the water broke in, approximately 100 barrels per day. After we finished with the mudding process and after the water had stood on the sand for a considerable length of time, we find that the well is now making 75 barrels of oil with about 15 per cent of water.

I regret at this time that I am not able to submit more in detail a thorough, complete and comprehensive report on both of these wells as I have been very busily engaged in other matters, which has prevented their preparation, and as I consider the use of mud-laden fluid a very desirous and scientific way in which to handle a number of our most serious difficulties, I wish to have all of those at this meeting understand me, in that I believe in it wholly and completely.

#### THE USE OF MUD FLUID IN ABANDONMENT.

By R. D. BUSH.

The American Petroleum Company, upon the suggestion of State Oil and Gas Supervisor, R. P. McLaughlin, recently abandoned Well No. 8, Section 19, T. 20 S., R. 15 E., Coalinga field, protecting the oil sands from water by the use of mud-fluid. The work was approved and inspected by this department, and its effectiveness is being demonstrated by the production of surrounding wells.

Abandonment was necessary since mechanical troubles made it doubtful whether the 8 $\frac{1}{4}$ " casing could be successfully re-cemented to shut out top water. The 10" cemented at 1712' was originally the water string and the well produced for several years from the sands below it. Later, edge water appeared in the upper sands and was shut off with the 8 $\frac{1}{4}$ " casing at 1885'.

In preparation for the mudding and abandonment, 1864' of 5 $\frac{1}{2}$ " and 1826' of 8 $\frac{1}{4}$ " casings were pulled out and the 8 $\frac{1}{4}$ " carried to 1980' and the well cleaned out to 200 $\frac{1}{2}$ '. Mud-fluid was obtained by mixing the surface formation, which was fairly good clay containing a small amount of fine grained sand, with water. A forty horse-power boiler and Gumbo Buster pump were set some 900' south of the well where the mud was mixed by circulating the fluid through the pump and discharging it through a hose into a 50' x 75' shallow reservoir made by plowing the ground and banking up the sides. The sand settled out to a great extent before the fluid reached the suction box at the pump. By adjusting the valves the pump discharged directly into the top of the 8 $\frac{1}{4}$ " casing at the well through a 2" line. The work at this plant was attended to by one man, with occasionally an extra helper, and the work at the well by two drilling crews of two men each.

No figures are available as to the yards of material pumped into the well, but some idea may be gained by an estimate of the time during which mud was being introduced into the well. The total time consumed in mudding, moving casing, plugging, cleaning out, etc., was 46 days of 24 hours and on every day except six mud was pumped into the well a portion of the time, occasionally with the 2" valve wide open, but generally barely opened, allowing just enough fluid to run in to keep the hole full but not running over, between the 8 $\frac{1}{4}$ " and 10" casings. In that

manner the oil sands took all the mud put in, the quantity gradually decreasing, until the hole stood full under the hydrostatic pressure only. A casing head was then put on with packing clamps between the 8 $\frac{1}{4}$ " and 10" casings and more mud pumped in until the pressure was up to 200 pounds and fell only 20 pounds in one hour.

For the first 16 days the 8 $\frac{1}{4}$ " casing was kept at 1927' and the sand at that point mudded first, until it required pump pressure to force mud into the well. The casing was then lowered to 1976' and the sands below 1990' mudded in the same manner. Plugs of brick and rope were then put in from 2004' to 1494'. The casing was then pulled up to 1784' and the upper sands mudded under pressure.

During the first portion of the work the mud-fluid was rather thin so that the mud would be deposited in the sand voids for a considerable distance from the well, thus building up a body of formation around the well which will be impervious to water. As the sands became clogged with mud, the fluid was thickened and the final column of fluid standing in the well to the surface is of maximum density and its hydrostatic pressure greater than the water in any stratum of sand, and thus will confine all waters to the sands in which they occur.

Evidence that the mud-fluid traveled away from the well when the fluid was thin is had from the fact that muddy water on the fifth day appeared in succession in the production of Wells Nos. 7, 6, and 5, being more pronounced in the nearest one, No. 7, distant 332' south, and least in No. 5, distance 1000' south, and discontinued after the fluid was thickened and required pump pressure to force it into Well No. 8.

Careful gauges of Wells 5, 6 and 7 taken during the month of August, 1917, during the mudding, show the following daily averages:

	Bbls. oil	Bbls. water
Well No. 5.....	13.4	346
Well No. 6.....	11.6	187
Well No. 7.....	18.0	227
Totals .....	43.0	763

Similar gauges taken during February, 1918, six months after completion of the work show the following daily averages:

	Bbls. oil	Bbls. water
Well No. 5.....	23.4	245
Well No. 6.....	31.1	169
Well No. 7.....	34.6	156
Totals .....	89.1	570

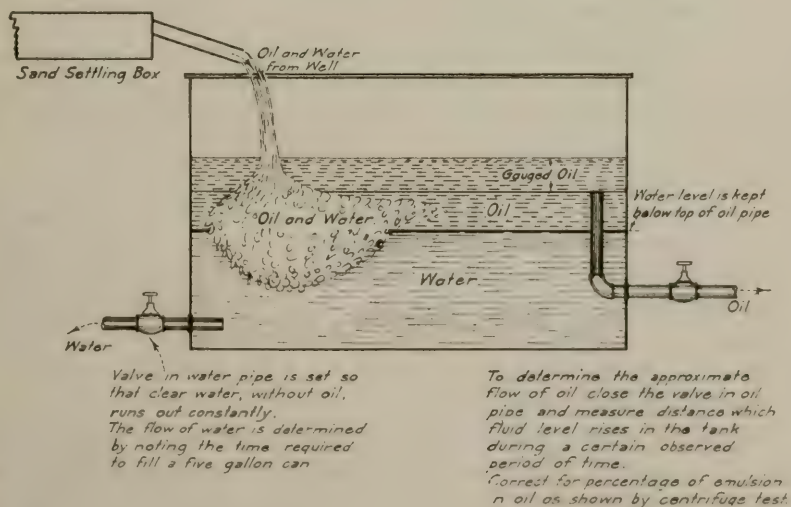
This shows a total increase in oil of 46 barrels per day and a total decrease in water of 193 barrels per day. The approximate cost of abandonment at Well 8, given by the American Petroleum Co. was \$1,831 for labor, material, oil and water. No credit is given for 1864' of 6½" and 1826' of 8¼" second-hand casings, and taking into account the additional production of oil, a substantial balance on the credit side is shown for the work.

MR. McLAUGHLIN: In connection with that paper I would like to call attention to something that probably might, at first glance, have no bearing on this subject. That's the method in which wells are gauged. I have noticed that there is a very careful system and a very good understanding by the American Petroleum Co. in the Coalinga field in the manner in which they gauge wells. I would like to have either Mr. Crumpton or Mr. Fuqua tell us why they gauge wells and how.

MR. FUQUA: I would suggest that Mr. Crumpton do that.

MR. T. J. CRUMPTON: Mr. McLaughlin asked me to explain why it was necessary to gauge this water and oil in such a manner as I have done. I would like to state now that the reason that I have done this is on account of the department pounding me on the back all the time

### METHOD OF GAUGING OIL & WATER AT WELL AMERICAN PETROLEUM CO. Coalinga, California.



for a lot of information that I could not get otherwise. However, I would like to state that, since I have done this in the method that I have, that it affords me enough information and I am very glad that they have forced me to do so. Most of our wells that are making a large amount of water are pumped into a sump and there is a water pipe running from it and an oil pipe running from it. The water pipe is regulated accurately as near as we can tell, by not allowing the water to rise high enough that you can see it in the sump by stirring it with a stick. This water is gauged by a 5-gallon can and we generally take about three or four days' gauges before really getting any accurate figures on the water.

The same way with oil, which is gauged with a 5-gallon can and these figures computed into barrels or gallons, and then a centrifuge cut of this gauged oil is made to determine the actual net oil that comes from the well. Where we have a tank, we have a suction pipe that comes up possibly half way in the tank which drains the oil off the top and the water runs out the bottom as shown in the sketch, (fig. 5.) The valve on the water line is regulated so that the water is drained off at the same rate that it is pumped from the well and is gauged with a 5-gallon can. When the oil is gauged the valve in the oil line is closed and after a certain time the height of the oil above the top of the oil pipe is measured. The well actually gets a little bit the worst of it from the pressure, but, as a matter of fact, where you have lots of water you don't accumulate over 2 or 3 inches of oil, so the hydrostatic pressure does not have much effect on the result.

#### **MUD-FLUID USED BY STANDARD OIL COMPANY.**

By R. C. STONER and C. C. SCHARPENBERG, Standard Oil Company (California).

MR. R. C. STONER: Speaking for the Standard Oil Company, we mudded several wells in the Kern River field and in some we had good success and in some we hadn't. The following is a history of our results of use of mud-fluid:

When the Monte Cristo Properties in the Kern River field were taken over by the Standard Oil Company, several of the wells were making enormous quantities of water. Mud-laden fluid was used in most of the Kern River wells to shut off the water, the following being wells which were worked on and in which mud-laden fluid was used to seal up the sands:

Well No. 6, Monte Cristo No. 2.

Section 32-28-28, Kern River.

This well, because of its greater depth as compared to surrounding wells, was suspected of being drilled into bottom water. We took out the 7½" casing and redrilled the well from 670' to 985', mudding hole as we cleaned out; we struck bottom water sand at 976' and mud went

away, afterwards showing up in Four Oil Company's Wells Nos. 3, 7, 8, 10 and 12 to the south and west. We put in a total of 390 yards of clay by mixing with mud mixer and running the mud in through 973' of 7 $\frac{3}{8}$ " casing until we got circulation: then dumped in 25 sacks of cement from 985' to 950', put in burnt wire line bridge against the walls of the hole at 950' and put in 30 sacks of cement from 950' to 890'. We then landed 7 $\frac{3}{8}$ " casing at 889' and perforated it.

Before working on the well it produced 5 barrels of oil and 300 barrels of water; it now produces 10 barrels of oil and practically no water. The effect on the Appolo's and Four Oil Company's wells was as follows:

Production, Four Oil Company, September 10, 1917.

	Before redrilling No. 6		After redrilling No. 6	
	Oil, bbls.	Water, bbls.	Oil, bbls.	Water, bbls.
Well No. 3.....		500	25	25
Well No. 4.....		200	15	30
Well No. 5.....	15	285	10	61
Well No. 6.....	7	393	20	100
Well No. 7.....		370	25	25
Well No. 8.....		501	20	
Well No. 12.....	10	390	25	11
Totals .....	32	2,568	170	251

Water in Nos. 4 and 6 decreasing.

#### Well No. 51, Monte Cristo No. 1, Section 5-29-28, Kern River.

Well No. 51 had been abandoned by the Monte Cristo Oil Company and in order to shut off the water the well had to be redrilled and top and bottom water both shut off. The hole was redrilled with 12 $\frac{1}{2}$ " casing to 545' and cemented with 12 $\frac{1}{2}$ " casing at this depth with 50 sacks of cement and 20 sacks of hydraulic lime. We then thoroughly mudded formations between the bottom of the 12 $\frac{1}{2}$ " casing and 720' with 75 yards of clay, shot cement pocket at 720', put in bridge and cemented 9 $\frac{3}{8}$ " casing at 720'; on drilling out cement found water shut off. We then carried the 7 $\frac{3}{8}$ " casing to 1014' and put in 250 yards of clay with mud mixer, applying air pressure of 275 pounds until hole stood full of mud. At this date well is standing full of mud. Before working on Well No. 51, Wells Nos. 26, 32, 40 and 44 were making about 1000 barrels of water and only a coloring of oil. This work shut off 95 per cent of the water in these wells and they are now making production as follows: No. 26, 15 barrels of oil, No. 32, 15 barrels of oil, No. 44, 40 barrels of oil and No. 40 is making no oil or water.

#### Well No. 13, Monte Cristo No. 1, Section 5-29-28, Kern River.

This well had been abandoned by the Monte Cristo Oil Company; rigged up to shut off bottom water. Ran in a string of 7 $\frac{3}{8}$ " casing and

cleaned out the bottom (1065'). For 30 days we mudded up the formations between 915' and 1065', using 600 yards of clay and 35 sacks of sawdust. Pumped mud in under 250 pounds pressure after getting circulation and followed it with  $3\frac{1}{2}$  tons of cement. The work of shutting off bottom water in this well was successful and it also shut off the water in Well No. 65. Before working on this abandoned hole, No. 65 was blowing 2000 barrels of water per day and no oil, it now makes 10 barrels of oil and very little water.

In all the work we have done in the old Kern River field, with one exception, to shut off the water, we have used mud to seal up the sands to stop the flow of water preparatory to cementing. The water on the old Monte Cristo property is constantly moving in the sands and this is proved by the sudden rise of water in the wells when some of the big water wells are shut down. Water has also been observed running in a well through a hole in the casing, without filling up the well. With this constantly moving water it is obvious that attempting to cement strings of casing or plugging with cement alone would be of no value.

In one job (Well No. 51) when shutting off bottom water, mud alone was used and forced into the formations under 275 pounds pressure. The  $7\frac{1}{2}$ " casing was carried to the bottom (1014') of this well and after thoroughly mudding, the  $7\frac{1}{2}$ " casing was withdrawn and the hole left full of mud. This well has been standing for one year full of mud.

From the work we have done in this field, it might appear to those not familiar with the Kern River field conditions, that our work would only be of a temporary nature, having been done with such an unstable substance as mud. However, it appears to me that under conditions as they exist in the Kern River field and under similar conditions the use of mud as we have used it in the wells described is entirely feasible.

In deep wells the use of mud does not appear to be so desirable. In case of a Kern River well, which has been mudded, again becoming a channel for flow of water into the oil measures, it is possible to open the old hole and re-seal the formations, in a deep hole it is doubtful whether the well could be successfully re-mudded.

Were it possible to make tests on a well and to re-mud the formations if necessary after the casing had been landed through the mudded formations, it could be kept sealed and the sands would so remain impervious to the flow of water or oil.

In most cases it would be impossible to pump mud behind a string of casing after it had been landed for any length of time. This I believe would be especially so of a long string (3000') of casing, which had been landed in a rotary hole. It might be possible to pump mud a short distance up behind the shoe or a short distance down from the surface on the outside of the casing, but bridges which would occur due to the caving of the walls of the hole against the pipe would prevent the hole

from ever being re-mudded and also render useless, observations as to whether the hole on the outside of the pipe was full of mud.

In the Midway field mud was used under similar conditions but the effect on the surrounding wells was very different.

During the abandonment of Midway Oil Company's Well No. 9, on Section 35-21-24, mud was pumped into the oil and gas sands, the mud showing up in Standard Oil Company's Monarch No. 4 gas well, located about 250' away, having a very unfavorable effect. Before mudding the Midway Oil Company's well, Monarch No. 4 made about 1,000,000 cubic feet of gas per day and had been making that amount for over a year; after the mudding the well began making mud and now does not make any gas.

Another instance where mud had a deleterious effect was when Eagle Creek No. 21 was to be abandoned. Tubing and rods had been lost in the well and when we proposed to abandon the well we endeavored to seal the oil sands by pumping mud down the hole. This mud went directly into the oil sands and was pumped out of Honolulu No. 12, which is about 600' away and down the dip of the formations. Honolulu No. 12 decreased in production from 100 barrels to 35 barrels and to date has not come back.

From the use of mud as we have seen it, we have had very favorable results in the Kern River field and very unfavorable results in the Midway field. This is no doubt due to the different conditions of the sands, structure and character of the oil. The use of mud seems to meet with more favorable results when used in shallow wells producing heavy oil than when used in deep wells producing light oil (25° gravity) and gas.

In conclusion I may state that mud has its uses but great care should be taken that low pressure productive oil and gas sands are not sealed up so that they will not unseal themselves, and also, that when mud is used to mud up sands when landing water strings, it seems advisable to follow the mud with cement.

C. C. SCHARPENBERG: Mud has been used in the drilling of oil wells by the rotary system in California for many years, having been introduced here from Eastern fields. It has been found in drilling that mud is necessary for the successful completion of wells through certain sand and shale strata containing water or gas, and the use of drilling tools adapted for working with mud-laden fluid had therefore increased until at the present time such tools are used almost exclusively.

Mud is usually considered to wall up the hole, mixing with the sand or other formations so as to give this material an angle of repose of 90 degrees. This angle of repose will be maintained usually for four to six hours, or perhaps longer, varying with conditions of use and formations, but should a rotary hole be kept full of muddy fluid and left

standing indefinitely it has been proved in many cases that a new balancing of pressures will take place, and a lower angle of repose will be established with consequent caving of the walls. It is also known that these cavings form bridges in the hole which are capable of bearing great weights so that often they have to be drilled through with drilling tools, the drilling being harder than in new formations. After such a bridge has been drilled through nothing solid is encountered to the bottom of the hole except perhaps other bridges which may have been formed. Thus it is possible that such a bridge may form, keeping the hole full of mud above the bridge and allowing a void to develop below, which on the new adjustment of pressures would allow an intercommunication of the contents of various strata. Such a condition can readily take place in a hole in which the casing has been landed and much damage done before detection. If other wells in the vicinity have been finished in like manner the difficulty in locating the source of the water until a condition could exist similar to that in the Kern River field. Conditions have been encountered in drilling with mud circulating in which the mud column did not support the surrounding formations and the drill pipe was struck, proving that a balancing column of mud will not support the walls of a hole drilled in the loose formations frequently met with in California.

If the formations can not be held in place, conditions are likely to result which in the course of time will permit entrance of water into strata from which it should be shut out. This leads us to a study of mud and some of its uses in other lines of industry, from which conclusions may be drawn as to its action in our work. Clay is composed of a complex series of aluminum silicates, with iron and other impurities; very little lime is present. If mixed with water the settling is very slow, the finer particles remaining in suspension in a fluid state for years, provided that there is no means of escape for the water. Sand is practically composed of silica, which when mixed with mud forms only a physical mixture. The pumping of mud into sand is the filling of the sand voids by the semifluid-mud; the continued pumping of mud into sand will soon so fill all voids that there is no further travel of mud into the sand. Thus a barrier has been formed similar to a wedge, which will allow no communication so long as an excess of pressure is exerted on its base by a semifluid mass. Should the supporting fluid become clear water, with oil or gas on the other side, there will ultimately be communication through minute channels by capillarity, since the material of which the plug is composed has but little hydraulic value, but is a mass of material held together only by the friction existing between the small particles of which it is composed. At this point the fact that sand and mud have no hydraulic value is to be emphasized; those formations in the earth which separate the different water strata or water from oil

and gas are in every case composed of material the deposition of which required a great period of time, or material of more or less hydraulic value was present, and that this deposition was aided by certain colloidal conditions in rendering these strata impervious to water. After the structure is broken as by drilling through it the clay can not be made as impervious as it formerly was. This is proved in the construction of earthen dams as there is always a certain per cent of seepage. In stopping of the seepage at the Austin dam, holes are to be drilled into the porous formation and cement grout forced in under pressure. This above condition is mentioned only to show that in clay placed artificially by capillary action water is transmitted from one side to the other.

In the Kern River field the western extension Sec. 27-28-27, Well No. 3, and all other wells drilled in this vicinity, it was noted that in drilling a 17" hole with a rotary there is a continual disappearance of mud even while the hole is standing, being kept full of heavy mud especially prepared for this purpose. The shrinkage amounted to about 96 linear feet per day. The cause of this disappearance is that a certain amount of water does seep away into the upper formation and the remaining part of the loss is due to mud being carried away by the water flowing through the water sands.

Another item of interest noted in this well was that while fishing with an overshot it was brought out full of fairly solid mud. This mud appeared to have caved from the wall above as it had attached a layer of sand, thus showing that the supporting of fluid did not counter-balance the formation pressure or give the formation an angle of repose of 90 degrees, but mention must be made that in most cases the sand is held in place better than some shales. In this field special mention can be made of the efforts to shut off water from the oil sands. The following is the procedure now gone through when ready to cement: 12½ casing set in rotary hole, about 100 cubic feet of clear water is pumped in ahead; about 200 cubic feet of hydraulic lime followed by about 250 cubic feet of cement, keeping lime and cement separate by packers in transit through casing. This mud is left back of casing, but no mud could be added outside of the pipe because of the caving of upper formation which takes place. The 10" casing is landed above the oil sand, the same procedure taking place as described above, except that the gate on the packing head outside of 10" is closed and cement is forced in to the formation under all the pressure that may be available under the limits of safety. By this means we have been able to shut off the water, all other means of mud and cement being failures.

The question of pumping clear water into the casing before cementing varies in different places. At the Lost Hills field by experience it was found necessary to introduce a quantity of clear water into the hole to wash the drilling mud away from the formation in order that the water

might be shut off with cement, but in other cases this clear water would cause caving of the formation so that cement could not be landed in place.

An interesting example of the use of mud-laden fluid is shown by Well No. 4, Derby, Sec. 16-32-24. Set 10" casing in formations with long shoe. Had heavy rotary mud back of pipe; stood for a day, started bailing, dumping mud in cellar; bailed to 1600 feet; cellar full of mud; formation gave way at shoe; all mud ran into hole from back of casing, showing that at certain places the formation is not strong enough to bear the weight of fluid back of pipe; and in this case cement should have been used in forming the seal at the bottom of the casing. Another interesting condition arose on this property, viz, Well No. 7. Hole drilled with rotary and full of mud, 12½ casing stuck at 1707 feet. While working at this depth with fishing tools the mud disappeared into the formation. If the above condition should take place in a well having several water or oil strata back of pipe with a caving of the walls of the hole there might be an intercommunication.

On going into new field it is found that very little mud can be pumped away into the formation, but on a decline of oil and gas pressure the sands will take up a great quantity of mud. Such is true of the Kern River field and also at certain places in Midway and Sunset oil fields. In some cases mud introduced into a well finds a path into the oil and gas passages, traveling for considerable distances. Several cases can be cited, viz, mud traveling from Well No. 9, Sec. 35, Midway Oil Co. to Monarch, Sec. 26, Well No. 4; from Well No. 21, Eagle Creek to Well No. 12, Honolulu Oil Co. Also in drilling it is often found that through strata which could formerly be drilled through only with difficulty, now can not be filled up with mud alone, but foreign vegetable matter must be added. This mud forced into low pressure strata often finds its way into other wells, as Sec. 36-21-23, Well No. 20 to Well No. 10, well flowing produced mud and causes considerable trouble. Judicious use of mud has its place and is very valuable to confine and plaster up formations temporarily but if backed by cement permanence and dependance can be shown. Examples can be cited by Wells 7, 10 and 16, Sec. 18-32-24, where water and oil were shut off by cement back of a string of pipe. Later the oil stratum was perforated, no water coming into the hole, one case making a 30 barrel well.

On Sec. 26-31-23, Well No. 6, it would be possible to have eliminated the string of 10" casing which was landed at 1968 feet, as a string of 12½ had been landed at 1648' and the 8½ casing at 2350'. The land about was practically undrilled and there was considerable gas pressure. The gas sands did not take much mud and had it been planned that the water and gas sands be kept separate by mud it would have been

necessary to have kept close watch that the mud did not unseal the sands, as other gas wells were drawing from these sands, lowering the pressure and having a tendency to draw large quantities of mud into the hole, if water from the sand above did not also come in. Should a bridge form below the 12½" casing the water would have had free access to the gas measures.

Every means possible on our part has been done to keep water from the gas sands on this property, but with all that the wells are showing more water as they increase in age.

In conclusion, will state that I believe the surest though somewhat more expensive way of protecting the oil and gas measures, is by far the best.

MR. McDUFFIE: There is one point that I would like to inquire. It seems that both he and Mr. Bush make a particular point that it is necessary to start in circulating with thin mud. I don't quite understand why the conditions of pressure, etc., would not vary just as well with the conditions of formations in abandonment. In a new well it might not be necessary to use thin mud at the start. I would like Mr. Pollard, perhaps he could explain why it is essential.

MR. POLLARD: In regard to using mud of a thinner nature for any particular work, that should be governed by the conditions that prevail. For instance, if a corrosive water is encountered, it is necessary to drive that corrosive water as far away from your well as possible. I am talking now along the lines of underground conservation, something that has been very little talked about in the oil industry at all. Where a corrosive water is encountered, in my mind the fluid should be put into that sand in a thinner nature than what it would under ordinary circumstances, for the reason that we are attempting to exclude that corrosive water and drive it back from the bore-hole as far as possible so that only in a case such as that or of the mudding up to a high pressure gas sand, it is also very good, but outside of those two conditions I don't know of any other condition that would call for thin mud being used, outside of the ordinary tempered mud as used in the ordinary way; but, in using in that manner, we know of instances, and I have instances under observation for a number of years where corrosive water has been excluded from the casing and stopped the water from eating the casing out and causing the redrilling and the wrecking of the field. That is in the Texas fields that I refer to. When the wells have been wrecked, we have pulled the casing and found the mill marks still on the pipe. It is a very serious thing to protect the casing from corrosive water, but aside from the two cases mentioned, I don't know why it should be used in a thinner nature.

MR. STONER: In California it seems to me the sands are not a sandstone, they are a loose sand, but very little cementing material, and a

heavy mud would probably be better as far as the California field than a thin mud because a thin mud would be more like water; it would go through most any sand.

MR. McLAUGHLIN: The Shell Company has been drilling some new wells in Ventura County and they have been using mud for somewhat different purposes than we have here, and I would like to have Mr. McDuffie make some few remarks, if you will, Mr. McDuffie.

MR. MCDUFFIE: In Ventura we get a flowing water and gas between 50' of the surface and we have no hard formation whatsoever. Now we find if we did not have the mud very thick, we could not hold it at all. What I wanted to particularly get clear in my own mind was whether it is the individual well or individual territory that determines whether you have to use high pressure, or whether you have to have thick or thin mud. That is, it is impossible to say, is it not, that it is necessary in one certain field to have a certain character of mud and a certain pressure. I was also very much interested in Mr. Pollard's remarks about the amount of sand the mud contains and I was wondering if he could, perhaps, enlighten us on the percentage of sand that is permissible. Assuming that your hole is taking more or less mud constantly and that you are constantly passing through sandy shale, can you sufficiently reduce the percentage of sand to about 2 per cent?

MR. McLAUGHLIN: If you have any details on that Mr. Pollard, we would like to have them at this time.

MR. POLLARD: I haven't the data here to present as official, but it has been my observation that the less sand that is in the mud, the more effective it will be. In regard to the artesian flow that he spoke of, the reason why he found it necessary, in my opinion, to use the mud so heavy, using the higher specific gravity of mud on that shallow sand helped him out, and if he had attempted to use thin mud in that case he would not have met with success: and his remarks in regard to wells being different, it is very seldom that I have ever worked on a well that did not present a different problem. That's where we have to be careful in using the mud-laden fluid in any territory and in any number of wells, because we will find the conditions will be different in most every case. I would like to say further that, in handling mud with a view of taking care of water, that, water in its own formation is not dangerous. It is only dangerous when we let the water get out of its own formation. If the water travels down on the outside of the pipe it becomes dangerous as is the same case when it has power to raise upwards creating a hydrostatic head, which it can not have when held in its own formation. If we can keep the water in its own formation we have repaired that damage we have done to nature by drilling the hole through it, and in this manner have overcome one of the greatest difficulties in preserving the territory, be it gas or oil. When we put casing

down on top of the gas we have protected that gas from escaping into adjacent formations, but when we deliberately go through a gas zone with the casing and then perforate it, it is impossible for us to expect to save our gas fields, and that in my mind is where a great deal of the trouble is coming from that we are experiencing in the Midway field today. In producing the gas, we have allowed it to come in contact with the formations, and thereby migrate and seek the point of least resistance and in a very short time our gas has disappeared. This condition is very much the same in regard to water troubles.

I have seen wells cased hundreds of feet above the pay-sand, and then the flow string into the pay, with the water course behind it to conduct the water into the sand whenever it gets ready. As a consequence, when the pressure becomes diminished on the fields the water starts a movement down the outside of the casing and then we wonder where it comes from. However, with it all I believe there is more brain work being displayed in California fields than anywhere else in the world. It is not to be wondered at, since the problems are so vast, that we have the troubles that we do. It is a marvel to me that some of our fields last as long as they do.

MR. McLAUGHLIN: We have one other paper describing the work in the Salt Lake field. Before that is presented, I would like to say that I am glad to see that we have as good attendance here as we have and I am going to pass this tablet around and I would like to ask you to put your name and address, or the company you are with, and pass it to your neighbor, please:

M. H. Whittier.....	Los Angeles
Wm. C. McDuffie.....	343 Sansome St., San Francisco
J. E. Elliott.....	343 Sansome St., San Francisco
T. E. Comins.....	404 Security Bldg., Los Angeles
J. H. Purdy, Sec.....	Olig Crude Oil Co.
J. J. McClemons, Supt.....	Olig Crude Oil Co.
Lionel T. Barneson.....	General Petroleum Corp.
F. J. Prehoda.....	Rancho La Brea Oil Co.
A. H. Liscomb.....	38 E. Union St., Pasadena
P. W. Garn.....	Montebello Oil Co., 902 T. I. Bldg.
S. H. Gester.....	Standard Oil Co.
E. J. Miley.....	State Cons. Oil Co., Baker-Det. Bldg.
S. C. Graham.....	Graham-Loftus Oil Co., Security Bldg.
G. M. Swindell, Sec.....	Chamber of Mines and Oils
T. M. Frampton.....	R.F.D. No. 1, Whittier
Robt. N. Bulla.....	Central Oil Co., H. W. H. Bldg.
C. E. Miller.....	Natl. Magnesia Mfg. Co., 544 Market St., San Francisco
Cyrus Bell.....	200 Bush St., San Francisco
P. W. Thompson.....	Standard Oil Co., Los Alamos
F. F. Hill.....	Union Oil Co.
D. T. Saine.....	R. D. No. 1, Box 57, Bakersfield
A. D. Fyfe.....	Casmalia, Cal.
D. B. Arrell.....	632 Title Ins. Bldg., Los Angeles
E. D. Nolan.....	Shell Co., San Francisco
W. S. Smullin.....	Whittier, Cal.
B. L. Cunningham.....	1007 S. P. Co. Bldg., San Francisco
F. E. Shafer.....	1947 Oak St., South Pasadena

B. E. Parsons	Gen. Pet. Corp., Taft, Cal.
F. Chappellet	1003 Higgins Bldg., Los Angeles
C. P. Bowie, Pet. Engr.	U. S. Bureau of Mines, San Francisco
E. G. Gaylord	1007 S. P. Bldg., San Francisco
W. B. Blodgett	A.T.S.F. Fuel Dept., Fellows, Cal.
F. C. Ripley	A.T.S.F. Fuel Dept., Kerekhoff Bldg., Los Angeles
C. C. Scharpenberg	Standard Oil Co., Bakersfield
Ray C. Stoner	Standard Oil Co., Bakersfield
M. E. Lombardi	S. P. Co., 670 S. P. Bldg., San Francisco
L. J. King	Associated Oil Co.
John T. Wooten	Amalgamated Oil Co.
J. Collins	R. D. 2, Fullerton, P. D. Co.
John A. Pollard, Supt.	Highland Div., Compton, Cal.
W. S. Clute	Pet. Midway Co., Ltd.
Henry S. Woolner	208 H. W. Hellman Bldg.
I. W. Fuqua	California Petroleum Corp.
W. J. Travers	Olinda Land Co., Fullerton
S. J. Hardison	Nevada Petr. Co., Coalinga
F. E. Twitchell, Supt.	Copa de Oro Pet Co., Brea
Lee W. Butler	Copa de Oro Pet. Co., 512 Cal. Bldg.
W. A. Butterworth	Fellows, Cal., American Oil Fields Co.
W. B. Robb	Ind. Oil Producers Co.
T. J. Crumpton	Fellows, Cal.

MR. McLAUGHLIN: Gentlemen: If you will come to order, Mr. Kirwan will read this paper worked out on the Salt Lake field and then Mr. Prehoda, superintendent of the Rancho La Brea Oil Co., will add some remarks to that.

MR. KIRWAN: This paper has been made for our annual report and we have made a few additions and corrections and possibly it would be well to read the paper and discuss it afterwards.

#### REPORT ON MUDDING AND CEMENTING OPERATIONS AT RANCHO LA BREA OIL COMPANY WELL NO. 41.\*

Sec. 15, T. 1 S., R. 14 W., S. B. B. & M., Salt Lake Field.

Along the line of development of the mudding process for excluding water from oil wells, which process has been used successfully in numerous instances in California, the following mudding operation is described more or less in detail with the idea that other operators confronted with similar problems may profit by the experience of this company in attacking such problems when the more common method of putting in cement plugs has failed.

Rancho La Brea Oil Company Well No. 41 was completed in September, 1911, at a depth of 955 feet, and made an initial production of over 100 barrels of oil per day and no water. The production of this well dropped considerably from the initial production until January 24, 1916, on which date the company filed a proposal to deepen this well and cement a string of casing below the oil sands, in order to protect them from water, which they expected to develop at a depth of about 1800 feet for use on the property.

Water sand was unexpectedly encountered at a depth of 1123' and

\*See also Chapter III, page 235, *post*.

Accompanying this article is a cross-section showing certain wells of Rancho La Brea and Salt Lake companies. A map showing the position of wells included in the cross-section is also given, (Fig. 6). Study of this cross-section shows that fairly regular geologic conditions exist in this area of the Salt Lake field. It will be noted that Rancho La Brea well No. 41, shown on the cross-section, has been drilled deeper into the formation than any of the other wells shown. A peg model constructed by this department shows that in general the formations dip in a southwesterly direction from the Rancho La Brea Company property on Section 15 towards the Salt Lake property on Section 22.



In the early part of April, 1917, Mr. George G. Hunt, an official of the Rancho La Brea Oil Company, requested the Deputy Supervisor in charge of the Los Angeles office, to suggest means of shutting off the water in this well. Detailed information regarding the physical condition of the well was requested, and subsequently received from the

company. A study of these records and an interview with the field superintendent of this company, Mr. F. J. Prehoda, brought out the fact that cement previously placed in the bottom of the well, was carried back into the formation. This probably accounted for the failure of the various cementing jobs to shut off the water. This department recommended that the company pump mud-laden fluid into the sands near the bottom of the well. Mr. Prehoda, who has had considerable experience in the use of mud-laden fluid, readily agreed to try the experiment, and co-operated with the State Mining Bureau in the matter of eliminating the water trouble which was spreading to adjoining wells on this and neighboring properties.

Previous to the beginning of mudding operations, Mr. Prehoda reported that the well had been bridged from bottom (1285') up to 1100', with brick and rocks driven down by the tools. On May 10, 1917, the bridge was drilled out to a depth of 1185' and mudding operations started. The oil string was set at a depth of about 1100', and mud about the consistency of rotary mud pumped into the well through three-inch tubing which extended to a depth of 1168'. About 24 hours after mudding operations were started in this well, Salt Lake Oil Co. Wells Nos. 329, 330, 347 and 348 and Rancho La Brea Oil Co. Well No. 38, pumped water carrying considerable mud. Upon request from this department the wells of the Salt Lake Oil Co. producing this mud were shut down.

After mudding operations had been in progress for over a month without any apparent success to mud up the formations, this department suggested that sawdust be used in addition to the mud in order to stop up the pores, or openings, in the formation penetrated by the mud. A favorable effect was immediately noticed in that, shortly afterwards, June 21, circulation was obtained. Following this, the well was thoroughly mudded by forcing mud-laden fluid into the formations under a pump pressure of 400 pounds per square inch. The well was shut down, leaving the mud-laden fluid standing at the surface.

Mr. Prehoda reported to this department that a total of about 700 cubic yards of adobe and 40 cubic yards of sawdust were pumped into the well during the first mudding operation.

On August 1, 1917, the mud was washed out of the well and the well bridged from 1109' to 1095' by tamping rock into the formation and the bottom of the well cemented with 50 sacks of cement pumped through tubing, bringing the top of the cement plug up to a depth of 1080'.

After cementing, the well was allowed to stand about three weeks and put on the pump and produced between three and four hundred barrels of clear, salty water per day. No mud used during mudding operations appeared in the well.

About a month after the cementing of Well No. 41, water again broke into Rancho La Brea Well No. 38. Subsequent to water breaking into this well, Rancho La Brea Well No. 41 was mudded a second time. This latter operation was started on November 13, and was finished on December 4. During this second mudding operation, four feet of the cement plug in the bottom of the well were drilled out, five old bull-ropes cut into three-inch lengths mixed with adobe, about 70 yards of adobe and 10 yards of sawdust were pumped into the well under a pressure of about 400 pounds per square inch. During this mudding operation, Rancho La Brea Well No. 38 was shut down. On December 11, when the pumps at Rancho La Brea Well No. 41 were practically "stalled" and the well taking only a small amount of mud, Well No. 38 was put on the pump and began to pump muddy water. Well No. 41 immediately began to take more mud. For three days Well No. 38 pumped muddy water and then started to pump a small amount of oil. According to the production report, this well produced 300 barrels of oil and 200 barrels of water during the month of December, 1917, while the mud-fluid stood at the surface in Well No. 41.

The information relative to work done at the first and second mudding operations at this well were furnished this department by Mr. F. J. Prehoda.

Accompanying this report is a statement showing the monthly production of oil and water of Salt Lake Oil Company's Wells Nos. 329, 330, 347 and 348, and Rancho La Brea Oil Company Well No. 38. These wells were directly affected, and produced mud during the initial mudding operation of Rancho La Brea Well No. 41. This table shows that these wells averaged a total of about 500 barrels of oil and 4445 barrels of water during the months of January, February, March, April and May, 1917. This was before Rancho La Brea Oil Co. Well No. 41 had been mudded up. The table shows that these wells were shut down during June and July. From August to January inclusive, these wells averaged 2259 barrels of oil and 4230 barrels of water per month, showing a net average increase of oil to 1759 barrels per month. This increase of oil is probably due to work done in mudding Rancho La Brea Well No. 41.

It is interesting to note at this time that the well is standing full of mud-laden fluid up to a depth of 140 feet from the surface, and from this depth up to surface, the well stands full of clear water. Previous to mudding operations, fluid stood at a depth of 173 feet and could not be lowered by bailing. The fact that mud-laden fluid and water stands at the level indicated, tends to prove that water is not penetrating the oil-bearing formations at this well. This is rather interesting in view of the fact that this well has been standing undisturbed for a period of about four months.

One factor of great importance in the study of water conditions in the area under discussion, is the presence of large quantities of water in certain wells in the Salt Lake field previous to penetration of "bottom water" in Rancho La Brea Well No. 41. Available figures indicate that Rancho La Brea Well No. 41 was not the cause of the principal water trouble in the adjoining wells. The mudding of this well, however, has bettered the water condition of the adjoining wells, and has resulted in a marked increase in the production of oil.

The main source of the present water trouble affecting wells of the Salt Lake Oil Company mentioned in this report, antedates the deepening of Rancho La Brea Well No. 41, and may possibly come from one of the abandoned wells which may have been improperly plugged.

It is the opinion of the Deputy Supervisor that while water sands in Rancho La Brea Well No. 41 may be mudded up, that the oil sands in this well have also been thoroughly mudded. This department has recommended that the Rancho La Brea Oil Company leave Well No. 41 shut down for a certain period of time. It has also been recommended that the Rancho La Brea Oil Company and the Salt Lake Oil Company gauge the production of certain of their wells located in the vicinity of Rancho La Brea Well No. 41, and furnish this department with the results of these gauges, in order that further study of the water situation in this area may be made.

STATEMENT TAKEN FROM MONTHLY PRODUCTION REPORTS FURNISHED  
THE STATE MINING BUREAU BY THE RANCHO LA BREA OIL COM-  
PANY AND SALT LAKE OIL COMPANY.

Month	Salt Lake Well No. 329		Salt Lake Well No. 330		Salt Lake Well No. 347		Salt Lake Well No. 348		Rancho La Brea Well No. 38		Totals	
	Bbls. oil	Bbls. water	Bbls. oil	Bbls. water	Bbls. oil	Bbls. water	Bbls. oil	Bbls. water	Bbls. oil	Bbls. water	Bbls. oil	Bbls. water
1917-January	359	49	174	551	235	2,705	2,325	*	*	768	5,630	
February	329	45		500	212	2,433	2,025	*	*	541	5,963	
March	184	122	130	520	179	2,061	123	1,102	†	†	616	3,805
April	90	510	120	480	240	2,160	123	1,102	†	†	573	4,252
May		375		475		2,150		475	†	†		3,475
June	*	*	*	*	*	*	*	*	†	†	*	*
July	*	*	*	*	*	*	*	*	†	†	*	*
August	418	302	494	266	580	420	420	280	†	†	1,912	1,265
September	630	1,170	720	1,080	205	1,845	760	1,140	†	†	2,315	5,235
October	720	1,089	760	700	205	1,845	720	1,280	†	†	2,345	4,995
November	630	770	960	640	189	1,620	713	1,663	*	*	2,483	4,693
December	630	770	923	616	168	1,512	440	1,760	309	200	2,461	4,858
1918-January	518	632	624	416	180	1,620	334	1,536	330	220	2,036	4,424

\*Shut down. †No report.

MR. PREHODA: In regard to Well No. 41 it was water we were after, being under the impression it was good boiler water. We intended to carry 6½ casing to the first shale below the oil sand and land it; but as the oil sand was running in we were unable to tell when the shale had been reached until water had made its appearance. The water was not

noticeable until we reached 1190' then it raised within 170 ft. of the surface. The well was drilled to 1248 ft. then the water tested as to its value for boiler purposes. Finding the water of no value we proceeded to plug the well and shut the water off. I had the well plugged to 1180' and cemented. After letting it stand three weeks, had it opened to test and found there was no cement; it must have washed away. Then it was plugged up to 1120' and again cemented it stood for three weeks more, and tested only to find the same results. The well was cleaned out and the 6 $\frac{1}{2}$  casing was allowed to follow, after which we found that shale had been gone through from 1085' to 1118'. The well was bridged to 1090' and was cemented. After standing a period of three weeks was tested and found the cement set but the water was not shut off. The well was pumping one month and produced only warm salty water. After consulting Mr. Kirwan we agreed to mud the well in hopes of mudding the passages which we thought were leading from this well to our No. 38 a distance of 500' away; also the Salt Lake wells which are from 1500' to 2000' distant. I had used the mud two days when Mr. Foster informed that his wells on the Salt Lake were pumping mud. After imparting this information to Mr. Kirwan he took the matter up with Mr. Wooten and wells were shut down and mudding started again. About 600 yards of adobe were pumped in, but could not get any circulation. Mr. Kirwan suggested that I get some sawdust and mix it in the mud, which I did, and after using some 25 yards, finally got a circulation ten to fifteen minutes at a time and the fluid would disappear. It continued this way for a week or ten days. Each day the circulation remained longer until the fluid did not leave. I kept circulating for one week and then let the well stand for about one month. Then I consulted Mr. Kirwan and we decided to pump the wells; the Salt Lake was notified and I started No. 38 on our property and it went to making oil the first day and the Salt Lake wells also showed more oil than they had for months before. After four weeks our Well No. 38 went to pumping mud again. I at once went to Well No. 41 and found that the fluid had gone down to the water level of 170'. Put a crew on mudding it again. This time I used bull rope chopped up fine and 8 yards of sawdust and 60 yards of adobe. Had no trouble in getting circulation and I had 400 pounds pressure put on the well after the pumping was started. I had No. 38 started to see if it would have any effect on the pressure and I found that it did. So I had the crew pump in mud for two more days when the pump was stalled again. Then let the well stand four weeks more, when starting it again it pumped muddy water for two days when oil began to appear and in one week was pumping 30 per cent oil and has been improving daily and at this writing is doing 50 per cent oil.

My first experience with mud was November, 1912. I had Mr. Perkins cement Well No. 51 for me. When I went to test the well, found the water was not shut off. We drilled about 20' further and then cemented the 8 $\frac{1}{4}$ ". The cement set that time all right, but the water was still there. We couldn't get circulation. I had a hydraulic pump there—2200 pounds pressure on it. I stated that we couldn't get circulation. I then got this mud and a tapering shoe. I drilled the hole ahead, got the mud all ready and I circulated the mud awhile and drove my shoe down into this small hole—I did not wait for it to set—but I bailed it out and let it stand for seven days and the well was just as dead at the end of seven days as it was the first day. From that time I went to using mud.

MR. KIRWAN: What was the depth of that well, Mr. Prehoda?

MR. PREHODA: On the drilling well? I think it was 1200'.

MR. KIRWAN: Do you think that was a combination of formation shut-off or due to the mud only?

MR. PREHODA: I think it was a good deal the mud.

MR. STONER: From the description of Well No. 41, all the mud you pumped went into the oil sands.

MR. PREHODA: I had my 6 $\frac{5}{8}$ " down below the oil sands.

MR. STONER: It is a question in different areas whether or not the oil would stand that much mud and come back.

MR. PREHODA: I don't know. I never pumped 41. Forty-one stands today.

Q. The mud you used was all black adobe mud?

A. Yes. All black adobe mud. Every day when we pumped this mud in the well we would first shovel all the sand that accumulated in the bottom of this sump hole out.

Q. How do you figure the oil got into the pay sand? Did the saw-dust stay out of your well into the bottom water sand?

A. Yes sir, and followed that channel. I have wells much closer than the Salt Lake that were never affected at all. In fact, I have one well that's in front of one of the Salt Lake wells and it is not affected, yet one of their wells was affected. It shows that there must be an underground channel connecting those wells together.

MR. STONER: In mudding up wells like that, the mud would follow the line of least resistance.

MR. PREHODA: The reason I don't think there is much mud in my own sand is this: I think after you mud a certain length of time, the mud accumulates below the shoe and would keep it out of the oil sand. I think it coats over just the same as in a rotary hole.

Q. This rotary mud that you used; was that light?

A. No, it is heavy.

**A PROCESS FOR REDUCING THE VISCOSITY OF HEAVY OIL.**BY E. A. STARKE.<sup>1</sup>

The oils of the Casmalia section of the Santa Maria field are of an exceptionally viscous and sticky nature. Their gravity ranges from some 8° to 16° B. With an average gravity of some 10° B. combined with high viscosity, it is impossible to commercially transport them by such means as pipe lines without subjecting them first to a preliminary treatment to raise their gravity and lower the viscosity.

It is only during the past few years that the importance of the heavy oils has been realized and their intensive exploitation carried on. Formerly these heavy oils had a limited use as road building materials, and in the manufacture of asphalt. As soon, however, as the refiners of light petroleum products placed the residuum from their refining operations on the market for the same purposes the demand for heavy petroleum fell off. In view of this, the heavy oil fields, such as those existing in Santa Barbara County, were neglected. Renewed interest, however, was taken in these fields when the demand for fuel oil rose to the figures we are witnessing today.

In order to be commercially useful, as a fuel, these heavy oils must be capable of transport through pipe lines without the application of heat, and, furthermore, their use must not be restricted to apparatus having specialized heating arrangements.

For the extensive fuel utilization of the Casmalia crude, a certain preliminary treatment is necessary in order to bring it up to the required standard. This treatment has heretofore consisted of heating the oil to a temperature of 180° F. and mixing therewith light distillate in a special type of mixer. In this way a high quality product is obtained which can be transported through a pipe line, and which meets the full market demands.

A number of objections arise against the above mode of treating the heavy crude, chief of which are the high cost and scarcity of light distillate, and secondly the fact that production of the mixed product is dependent on the supply of light distillates obtainable. A third important objection rests on the ground that full value is not obtained from the crude oil in this manner. For these reasons other methods of treating the crude were found imperative, with the result that the Doheny-Pacific Company adopted, at its Casmalia property, a process patented by the writer in 1905, and which had already been proved commercially successful.

The Starke process is based on the principle that when a heavy asphaltic oil or residuum is heated to 700° F. the crude oil suffers dissociation or cracking, particularly that part of the crude which renders

<sup>1</sup>We are enabled to publish this article through the courtesy of E. A. Starke, Chemical Engineer, Berkeley, California.

it sticky and viscous. In order that the process can be carried out successfully it is necessary that the oil be dry, as water interferes with the cracking operation. Not only does this method reduce viscosity, but a certain percentage of synthetic gasoline is formed. If it is desired to obtain a large percentage of this cracked gasoline, it is necessary to employ pressure. However, even when the prime object is to reduce viscosity, from 3-6 per cent of synthetic gasoline is formed during the operation. It is advisable in all events to so employ the process that the largest amount of synthetic gasoline under the given conditions is obtainable. In this way the operating costs are lowered.

In a general way the process as it is practically carried out consists in pumping 100 barrels of dry oil into a 125 barrel still. Approximately 40 barrels of oil is now distilled off. The heat under the stills is then discontinued, and the distillate is reunited with the residuum contained in the still. This may be done either by first cooling the still and adding the distillate, or by mixing the distillate and residuum without preliminary cooling. The last method is the one generally adopted. In this way the cold distillate is thoroughly mixed with the heavy asphalt still bottom, at the same time cooling the mixture sufficiently so that the charge can be withdrawn. The resulting product has now a gravity of between 11-12° B. and the viscosity is about equal to that of a 16° B. Kern River crude. The heat units per barrel are equal to those of the Kern River crude, about 18,800 B.t.u. but being of a lower gravity. A barrel of this processed oil will produce more steam than a barrel of the Kern crude or residuum. The viscosity of the oil produced will necessarily be dependent on the amount of distillate taken from the crude and then reunited. If, however, more than 50 per cent of the crude is removed during the distillation process, a certain amount of carbon is formed which would be classed as an impurity. Actually this carbon is so finely divided that it does not interfere with the uses of the oil.

During the distillation from three to five per cent of the oil is given off as a gas which contains much of the sulphur present in the well. This gas is burned under the stills as fuel. Considered in detail, the plant as operated on the Doheny property presents the following features:

A continuous distillation system utilizing a battery of four stills working as a unit. These stills are of 600 barrel capacity and are provided with the necessary preheaters, condensers and other distilling accessories. Comparatively dry oil is pumped through a heat exchanger into still number one. Here the temperature of the oil is raised to that point at which the most volatile fractions are given off. The oil then passes from the bottom of this still into the center and back section of still number two, maintained at a higher temperature than still number

one. Here a second fraction is given off, and passed into the condenser. From still number two the oil flows into the center of still number three, maintained at a higher temperature than the preceding two. Here a third portion of the volatile constituents contained in the oil are given off. From the third still the oil flows into a fourth one. Here the oil attains a temperature of about  $750^{\circ}$  F. and the remaining fractions distill off.

The residuum of still number four is now passed through the inner tubes of the heat exchanger before mentioned, where it loses a part of its heat to the incoming crude. From the heat exchanger the residuum flows into a sort of churn where it is mixed with the distillate portions recovered from the various stills. The resulting mixture is now limpid and can be pumped and used in the same manner as the  $16^{\circ}$  B. Kern River oil, and is equal in quality to the best crude used for fuel purposes.

In conclusion it may be stated that with the increasing use of synthetic gasoline as a source of motive power, the heavy petroleum oils assume an important role from an economic standpoint, and such methods as the one described, by which both high grade crude fuel oil and synthetic gasoline are obtained, merit the attention of the oil producer.

## CHAPTER II.

COMPARISON OF VARIOUS METHODS OF EXCLUDING WATER  
FROM OIL WELLS IN CALIFORNIA.(As shown by results of *test for water shut-off*)

By R. E. COLLOM, Chief Deputy.

All of the mechanical operations at a drilling well which aim at the protection of productive oil or gas bearing formations from infiltrating waters, and also certain geologic features, contribute data for determining the result of the test for water shut-off. These data include:

- (1) Total depth of hole and depth to which hole is bridged to land water string.
- (2) The method of drilling: Rotary or Cable.
- (3) The diameter, weight and length of casing used as water string.
- (4) The method of making water shut-off.
- (5) Such natural features as stratigraphic position, chemical composition and hydraulic head, or fluid-level, of water or waters excluded.
- (6) Record of all other formations entered, both above and below the depth of shut-off, including oil, gas and water.

In this paper the various items specified above are discussed only as they apply to operations for shutting of *top* or *intermediate* waters in the oil fields of California.

**Definition of Terms.**

*Water shut-off*: The term water shut-off is commonly applied, in California, to the condition whereby waters, native to strata penetrated in drilling, are excluded from the well and prevented from moving below a given depth, by landing or cementing a string of casing at that depth.

*Top water*: The term top water is applied to waters overlying the shallowest productive oil zone in any given area.

*Intermediate water*: The term intermediate water is applied to waters native to strata lying between any productive oil zones.

*Water string*: A water string is a string of casing which is used to exclude water from an oil well.

**Source of Data.**

The official<sup>1</sup> reports on test of water shut-off of the Department of

<sup>1</sup>There are two kinds of reports issued to operators: (1) Reports on Test of water shut-off; and (2) Reports on Proposed Operations. The reports all bear serial numbers showing the kind of report, the district from which the report originates, and the individual number of each report. Thus, Report No. T 1-24 is Report No. 24, on test of water shut-off, originating in District No. 1. Likewise, Report No. P 3-56 is Report No. 56, on proposed operations, originating in District No. 3. Each of these reports bears a decision or recommendation, either relative to a test or to certain proposed work. The decisions of the respective districts are summarized for the Annual Report, and appear under the subject "Decisions," in the chapters covering work done in each district during the fiscal year.

Petroleum and Gas, issued from the various field offices during the fiscal year closing June 30, 1918, are the principal source of the data in items 1 to 5, inclusive, referred to above. They are taken from 890 reports on test for water shut-off. They are tabulated by districts, fields, and sectional or lease locations in Tables I, II, III, IV and V. These tables are printed on pages 148 to 195. The respective results of test and supporting remarks are also given in the tabulations. Complete data were not available in all instances.

With few exceptions, only those reports on shut-offs made in the process of new work or deepening operations are considered in this discussion. This excludes numerous tests of the efficacy of plugs for shutting off water below productive formations—so-called “Bottom water”—or plugs in abandonment jobs, or tests of strings set with packer in redrilling jobs. These are more properly remedial operations and, therefore, are aside from the purpose of this discussion.

#### Tests.

The usual pumping or bailing test for water shut-off is made to determine one specific question, namely, whether or not water is prevented from passing around the shoe of the water-string and into the well. It is well worth noting that when a pumping or production test is made, a positive answer can be given *only* if the production shows no water. If water is present, it is evident that the source of the water can not be determined by the mere act of pumping the well. In such cases it therefore becomes necessary to bridge or plug under the water string, or perform other operations, in order to determine the source of the water. Pumping or production tests, although apparently expedient for quickly getting the well on the producing list, should be avoided where it is possible to do so. It becomes increasingly difficult and distasteful to perform the necessary testing and corrective operations as the well is deepened through formations below the shoe of the water string. The time to determine whether or not a string of casing shuts off water is when the minimum number of complications can enter into the results. Such possible complications will be discussed later under Factors in Results of Tests.

The following are the necessary steps in a bailing test<sup>1</sup>:

- (1) *Bail the well to bottom or to a predetermined fluid level.* The correct depth to bail a hole depends upon (a) the fluid level of water back of the casing, (b) the strength of casing to resist collapse, (c) the nature of formations and condition of the hole at or shortly below the shoe of the casing.
- (2) *The well should stand undisturbed for at least twelve hours.* Neither bailer, tools nor casing should be run in the hole during this time.

<sup>1</sup>Method of testing Water Shut-off at Oil Wells. Second Annual Report, Bull. 82, Cal. State Mining Bur. pp. 57-58.

- (3) *At the time for test, run the bailer to determine amount of increase of fluid and depth of hole.* It is assumed that careful measurements were made to determine exact depth of shoe and that the casing was tested for leaks before the time for test of shut-off. Bailer or tools should show sample of formation.

### **Depth of Hole.**

Under the caption "Depth of Hole" in Tables I to V inclusive, is shown the total depth drilled and, where a bridge was reported, the depth to top of bridge. When no bridge was reported the depth shown is that which the hole measured at the time of test. Rules for measuring depths of wells and casing, as applied to work passed upon by the State Oil and Gas Supervisor, were published in the Second Annual Report<sup>1</sup>. The depth of well, in all tests, is determined by running a bailer or string of tools to the bottom of the well. It is necessary to check carefully the distance the derrick measures-over on the sand-line or drilling-line. This distance is the basis of all measurements at tests. In rotary holes there is often a considerable discrepancy between the depth of hole measured by drill pipe before cementing and the depth measured at the time of test. The first depth, especially in contract holes, is usually "long." Where there is a considerable discrepancy in these measurements the question arises as to whether or not the hole is actually open below the shoe of the water string. For example, report No. T 4-1012<sup>2</sup> states that the casing was first reported cemented at 2205 feet, and later reported cemented at 2188 feet, based on measurement of drill pipe after drilling out the cement. With this discrepancy of 17 feet, it would be difficult even to imagine the exact depth of hole and position of shoe.

For the ideal testing conditions, the hole should be open to formation in place, and no deeper. Ordinarily, five feet ahead of the shoe is sufficient.

When the hole has been bridged, aside from the condition discussed above, an entirely different set of factors enters the problem. These will be discussed later under Factors in Results of Test.

### **The Method of Drilling.**

Discussion of methods of drilling is here confined to the efficiency of operations with rotary or cable tools in landing casing to shut off water. Cost and time sheets of the adherents of either method should, as far as economy of operations, up to the time of shutting off water, is concerned, present substantial reasons for the preference for which ever method is used. However, the question of economy in drilling an oil

<sup>1</sup>Second Annual Report, Bull. 82, Cal. State Min. Bur. pp. 59-60.

<sup>2</sup>See Decisions, Midway Field, Sec. 9, T. 32 S., R. 24 E., M. D. B. & M.

well is not finally determined until water is excluded and the well is completed. If, in cementing the water string, or attempting a formation shut-off, the job is not successful, the operator is confronted with the alternatives of redrilling, or of recementing, or of landing another string of casing or a liner. The expense of such operations is a considerable addition to the originally estimated cost. In order to operate at a minimum cost, it is well to consider, therefore, in what manner, if any, the method of drilling influences the operation of shutting off water.

In Tables I to V, under the caption "Water String," the method of drilling, whether by rotary or cable tools, is given for most of the wells. Also, in these tables, under the heading "Result," the successes and failures in each instance are given. Table VI gives a recapitulation of these items, with respect to successes and failures, for both methods of drilling. It also gives the percentage of failures for each method and the average percentage for both. The first six fields listed are those in which there was sufficient use for both methods to warrant comparison. There are ten fields, including Ventura County, in Group 7, in which the majority of the work was done with cable tools. This group shows that the proportion of failures, in landing water string with cable tools, is 15.5 per cent. The proportion of failures with cable tools, for all fields in the state, as shown in Group 8, is 14.4 per cent; and failures with rotary tools, for all fields, 21.8 per cent. In other words, for every three failures with rotary tools, there are only two with cable tools.

A study of Table VI shows, however, that this apparent disadvantage in the rotary method is due principally to results of operations in the Coalinga and Sunset fields. The failures, with rotary and with cable, for these two fields, are in the ratio of four to one. The Coalinga field shows 3.6 per cent failures with cable tools, which is by far the lowest for the state. The failures with rotary tools are 16 per cent for the Coalinga field. This is 6 per cent lower than the average for the state, and 3 per cent higher than the Midway field. The latter has the lowest percentage of rotary failures of all fields. The Sunset field shows 11.8 per cent failures with cable tools, which is two per cent lower than the average for all fields, and ranks next below Coalinga and Midway. The failures with rotary tools are 50 per cent for the Sunset field. This is by far the highest for either kind of tools in any field in the state.

It should be noted, before passing to the probable causes of failures in Coalinga and Sunset fields, that the respective percentages of failures for the rotary and cable tool methods, in the Midway, Coyote Hills, Montebello, and Lost-Hills-Belridge-McKittrick fields, do not vary a great deal from the percentages of combined failures for the respective fields.

TABLE VI. Comparison of Success and Failure of Water Shut-off as Between Casings Landed With Rotary and With Cable Tools.

Field and tools	Number of jobs			Percentage of failure
	Success	Failure	Total	
1. Midway—				
Rotary .....	87	13	100	13.0
Cable .....	76	8	84	9.5
Totals .....	163	21	184	11.6
2. Coyote Hills—				
Rotary .....	11	4	15	25.7
Cable .....	11	*5	16	31.2
Totals .....	22	9	31	29.1
3. Montebello—				
Rotary .....	18	†10	28	35.7
Cable .....	11	†6	17	35.3
Totals .....	29	16	45	35.5
4. Sunset—				
Rotary .....	19	†19	38	50.0
Cable .....	30	4	34	11.8
Totals .....	49	23	72	31.9
5. Coalinga—				
Rotary .....	73	§14	87	16.1
Cable .....	54	2	56	3.6
Totals .....	127	16	143	11.2
6. Lost Hills, Belridge and McKittrick—				
Rotary .....	32	‡7	39	18.0
Cable .....	67	14	81	17.3
Totals .....	99	21	120	17.5
7. Whittier, Puente, Olinda, Brea Canyon, Newhall, Ventura County, Santa Maria, Casmalia, Cat Canyon, Arroyo Grande, Kern River—				
Cable .....	185	34	219	15.5
8. All fields—				
Rotary .....	240	67	307	21.8
Cable .....	434	73	507	14.4
Totals .....	674	140	814	17.2

\*Five cable recementing jobs not included.

†Four cable and five rotary recementing jobs not included.

‡Five rotary recementing jobs not included.

§Two rotary recementing jobs not included.

#One rotary recementing job not included.

In the Montebello field the proportion of failures for both kinds of tools—rotary 35.7 per cent and cable 35.3 per cent—are double the average for both methods for all fields—17.2 per cent. This is probably due to the uncertainties and hazards of drilling in undeveloped territory. Until a number of wells have been drilled, formations carefully logged, and experience has indicated the stratigraphic position of suitable formations in which to land casing for water shut-off, the hazard

is greater than that which should obtain under settled conditions for drilling. In the developed fields, the operator's engineer can forecast with considerable accuracy, by the use of well logs, cross-sections, peg-models, subsurface contours, and other data, the depth at which a desirable stratum should be entered by the drill. The accuracy of the data is due to the additional fact that nearly all of the early development was done with cable tools.

The advantages that accrue from the use of such data is instantly reflected in a study of the percentages for Coalinga field operations. Coalinga operators are virtually the pioneers in the use of engineering methods for the study and direction of operations for shutting off water. The disadvantages of the use of rotary tools are, therefore, emphasized by the results in this field.

Inspection of Tables I to V, inclusive, shows that of 67 rotary failures for all fields, only two of the jobs were formation shut-offs. The Perkins cementing method explained on page 133 was used in 81 per cent of 65 cementing jobs.

#### Rotary Drilling in Coalinga and Sunset Fields.

Use of the rotary drill is confined principally to the East Side field in Coalinga. Stratigraphic conditions are quite consistent there. The Red Rock and top of Brown Shale<sup>1</sup> are good formational markers, and engineers' estimates, based on these markers for depth of oil bearing formations give close results. For example, the following statement is taken from comments on report No. P 5-318<sup>2</sup>, in the list of Decisions, Coalinga field:

"The well was surveyed by this department, and from the correct data an estimate was made which agreed within 4' with the result as found by drilling."

Rotary failures are undoubtedly due to (1) discrepancies in measurements of rotary holes, already mentioned under "Depth of Hole," page 112; (2) the inability to log accurately the nature of formations entered; and (3) impossibility of bailing the hole to identify oil or water-bearing strata while drilling. It is not only possible, but it is quite necessary, to make close estimates for depths to land water string in the Coalinga East Side field. This point is illustrated by reference to recommendations on "Reports of proposed operations for the Coalinga field". Report P 5-81 recommends shutting off water at 2370 feet instead of 2355 feet as proposed. Report No. P 5-100 recommends that water be shut off at 1980 feet instead of 1955 feet. Report

<sup>1</sup>See First Annual Report, Bull. 73, Cal. State Min. Bur. East Side field—principal formations, pp. 62-65.

<sup>2</sup>Decisions, Coalinga Field, Sec. 2, T. 19 S., R. 15 E., M. D. B. & M. Standard Oil Co., Well No. 10, Report No. P 5-318. Chapter VII, *post*.

<sup>3</sup>See list of Decisions, Sec. 14, T. 19 S., R. 15 E., M. D. B. & M., Coalinga field.

No. P 5-306 recommends cementing at 2495 feet, instead of 2515 feet, as proposed. It will be noted that these differences are 15, 25 and 20 feet, respectively.

The above differences in estimates indicate that it is necessary to make water shut-off in a stratum of no great thickness. It is also necessary for the rotary driller to recognize and accurately log the marker formation and water and top-oil, in order that the engineer's estimate may be checked and revised, if necessary. In a number of cases in the Coalinga field and elsewhere, the rotary has not fulfilled this necessity. The items listed under Sec. 29, T. 19 S., R. 15 E., M. D. B. & M., Table V, give a case in point, with the exception that the red rock is not known to be present in this area. The various operations at this well are covered in list of Decisions for Coalinga field<sup>1</sup>. These operations exemplify the difficulties and additional expense mentioned in the opening paragraph of this section. Briefly, the operations were these:

The company proposed to cement casing at 2675 feet, estimating top of oil at 2695 feet. The department recommended cementing at 2650 feet. After considerable discussion relative to location of top oil sand (based on rotary log), the company cemented 10-inch casing at 2696 feet. Report No. T 5-68 shows that, after bailing for test, 760 feet of water entered the hole in 21 hours. It was later conclusively proved, by ripping the 10-inch casing at 2655 feet, that an oil sand existed at that depth. The record shows that not only had the rotary passed through an oil sand, but that the shoe of the casing was landed in a zone composed of the unrecognized oil sand and sandy shale—material entirely unsuitable for shutting off water. It may be noted, in passing, that the rotary log of this well catalogs a noninformative succession of strata, logged as clay and boulders, hard sand, shale and shell, for 2669 feet. Rotary "boulders" are usually the evidence of a condition, but not of a formation.

Careful operators in the Coalinga field are already questioning the practicability of present rotary programs. The writer is informed that at least one of the larger Coalinga operators is preparing to make a radical change in the present method of drilling. Such a change will involve landing a string of casing with rotary near the red-rock marker and carrying a smaller diameter casing with cable tools for water shut-off at the top of first productive oil.

The following evidence, taken from the transcript of a hearing<sup>2</sup> before the State Oil and Gas Supervisor, gives the opinions of rotary drillers and operators relative to the difficulties mentioned above. The evi-

<sup>1</sup>Decisions, Coalinga field, Sec. 29, T. 19 S., R. 15 E., M. D. B. & M., Shell Co. Well No. 7.

<sup>2</sup>Hearing relative to the drilling of Union Oil Company's "International" Well No. 7, Sec. 4, T. 11 N., R. 23 W., S. E. B. & M., Maricopa Flat, Sunset Field, held at Taft, California, April 9, 1918.

dence, centered about the drilling of certain wells with rotary in the Sunset field, is entirely applicable to the present discussion:

MR. COLLOM (to Witness E. A. Whitten, driller, Union Oil Co.): I would like to ask Mr. Whitten if he believes in drilling through this top sand, where it is of a thickness of twenty feet or so, whether the returns from that well, from that sand, would show at the surface of the well, even if the sand were present.

A. Oh, yes.

MR. COLLOM: You believe it would be possible to detect the presence of that sand?

A. You can not tell in your returns from your rotary, but you can tell the way the mud is pumping.

MR. COLLOM: Can you tell which ones are water sands and which ones oil sands?

A. We have encountered oil sands in spots, and by little bubbles of gas you can locate pretty closely by rotary drilling.

MR. COLLOM: What we are trying to get at in a condition of this kind is whether it would be possible to pass through it without detecting it with a rotary. We will say the drill plunged through that sand, but there would be no means of telling when the returns came to the surface that you have been passing through a water sand or an oil sand.

MR. SCHNEIDER (Commissioner): It would show some discoloration or something to show that it had some signs of life.

MR. COLLOM: As a matter of fact, it is a pretty risky matter to depend upon a rotary?

MR. SCHNEIDER: Yes, it is.

MR. McLAUGHLIN: Let me ask the rest of the Commissioners if they are not convinced of that.

A COMMISSIONER: I think you can.

MR. McLAUGHLIN: Mr Saine?

MR. SAINE (Commissioner): I believe you can.

MR. McLAUGHLIN: Mr. Ballagh?

MR. BALLAGH (Commissioner): I think you can.

MR. McLAUGHLIN: Mr. Schneider, you are the only one who agrees with me that it is risky. Oh, Mr. Williams, I forgot to ask your opinion. Mr. Williams, isn't it risky? Can you always pick out a sand and know that it exists when you are drilling with a rotary?

MR. WILLIAMS (Commissioner): It would be rather risky. If it were a good lively sand it might show up, but if it were dead it might take twenty feet without showing. It all depends on the character of the sand.

MR. McLAUGHLIN: As I understand, what they have been trying to bring out is that there is some difficulty in locating a sand with a rotary.

MR. SAINE: I might be able to help you. In drilling with a rotary there are only certain formations that you can plunge through. Now, if he was drilling in a clay or shale and then struck an oil sand it would begin to plunge, and he would undoubtedly stop until he got the returns from that formation from the

bottom of the hole and washed it out to see whether he had any sand. He could tell, a man that is accustomed to it, could tell almost the minute his formation changed whether he was drilling in clay or shale, or a sand, or a shell.

\* \* \* \* \*

Clay Trammell, being first duly sworn, testified as follows:

MR. JOHNSON: What company are you with?

MR. TRAMMELL: Lake View No. 2 and Interstate Oil Company.

MR. JOHNSON: And you are working as a driller for this company, are you?

A. Yes, sir.

MR. JOHNSON: In drilling wells in the Maricopa Field, have you ever, in drilling with a rotary, known of a case where your drill ran through the top oil sand and you failed to find a sand, detect it, in drilling?

A. Yes, sir.

MR. JOHNSON: What well was that, Mr. Trammell?

A. Well No. 20, Interstate. We drilled by the sand, or I did myself, and at that time I recorded it as being a soft formation, and then afterwards we circulated, well, I don't know, but we drilled on through this and afterwards went on with the rotary. But we gave it plenty of time.

MR. JOHNSON: Do you know whether on Lake View No. 2 there was a similar condition?

A. Well, I can't recall whether we actually drilled through the sand on Lake View No. 2.

MR. JOHNSON: Is it your opinion that it is possible to pass a sand in a thickness such as in the one we have been discussing with the rotary without discovering its character?

A. You certainly can if you are not very careful.

MR. McLAUGHLIN: By being very careful you mean every man on every tour would have to watch it all the time?

A. Yes, sir.

MR. COLLOM: In drilling through this particular sand on Interstate No. 20, how long did you circulate until you noticed, until you were able to detect sand in the returns?

A. When a well is 2500 feet two hours or two hours and a half gives plenty of time. Before you do that, before you start in circulation, the principal thing is to clean your ditch so this will show up, wash your ditch out good, and then your returns will show exactly from where you are drilling.

MR. COLLOM: Great care would have to be exercised in order to be able to catch it, and in the case you mention it would probably take three or four hours before you got returns at the surface.

A. It would take that long to find a change of the formation. Of course, if there was a change of formation you would know it.

MR. COLLOM: Of course, in the particular well that you are speaking about, No. 20, as soon as you got within the zone of the soft sand you would know it.

A. We have the measurements of the well correctly and I know that I had got into something soft, and I drilled on down until I

had a change of formation: I didn't know just what it was; but I was looking for this sand at the time, but I had to go ahead until I got the change of formation.

MR. COLLOM: In this particular case, Mr. Trammell, if you had continued drilling ahead, when you struck this soft sand, is it or is it not probable that you would have been able to detect the returns after two or three hours' drilling?

A. I hardly think so. It would be difficult if you don't look.

Most of the failures for the rotary drill in the Sunset field are listed in Table IV under Sections 4 and 5, T. 11 N., R. 23 W., S. B. B. and M. The formational conditions here are much more complex than in Coalinga. However, the persistence and regularity of the many water and oil bearing formations permit correlation of strata in cross-sections, with considerable assurance. The major causes of failure attributed to drilling in the Coalinga field also apply here.

It is true that the proper preparation of the hole, prior to making water shut-off, has a great deal to do with the success of a job. There has been considerable speculation as to whether or not rotary mud, near the shoe, prevents a successful shut-off. If the mud fluid near the shoe is completely displaced with cement, all other conditions being favorable, the job would be a success. However, the results of cementing operations, which will be discussed later, undoubtedly throw the burden of proof upon this phase of rotary drilling, rather than upon the method of cementing.

In order to make successful shut-off, especially where the strata of suitable formations are thin, the rotary works at a disadvantage. It is required to locate definitely, by the speed of drilling and the length of time it takes returns to get to the surface, various changes of formations and the depths of such changes. The testimony of drillers has shown that this is difficult to do. The time required for formation samples to be conveyed to the surface in the circulating mud increases directly with the depth of hole and thickness of mud, and inversely with the speed of circulation. Therefore, the greater the depth the greater the chance of error in making a correct log. It is required to make suitable landing of water string, in formations thus logged, depending upon the measurement of hole as shown by drill pipe. It is evident that there are many mere approximations than known quantities in the foregoing, and an error of ten feet, or even five, considering the thickness of the formations sought, is enough to make the difference between success and failure.

In view of the fact that 50 per cent of the rotary jobs in the Sunset field were failures, it is evident that rotary methods, with respect to the requirements mentioned, are in need of considerable study and improvement.

The following is the average thickness of strata in the Sunset field, where the most failures occurred, in which suitable formation for shut-off must be found:

Below "Lowest Top Water" and above Oil Zone A—30 feet;

Below Oil Zone A and above "Upper Flowing Water"—25 feet;

Below "Upper Flowing Water" and above Kinsey Sand—50 feet;

Below "Lower Flowing Water" and Wilhelm Sand—40 feet.

Details of the difficulties and failures incident to the drilling of certain wells in this area are given in Formal Order No. 5, Union Oil Co. well No. 7 (International), and the accompanying tables and graphics, pages 413 to 450. Complete details of oil and water zones encountered from the surface downward are given by Deputy Supervisor R. N. Ferguson in the Second Annual report.<sup>1</sup>

### **Diameter, Weight and Length of Casings.**

One of the principal advantages of drilling claimed for rotary tools is that long water strings can be landed with a minimum use of conductor casings. The sizes of casing to be used depend upon formation conditions and the depths to be drilled. In some areas the choice of either rotary or cable method of drilling will cause no difference in the casing program to the depth of landing water string.

In order to give a more concise idea of the amount of drilling done by each method, as to depth of hole and diameter of water strings, the itemized data for these features, as shown in Tables I to V, inclusive, have been summarized in the form shown in Tables VII, VIII, IX, X and XI. In these tables segregations are made under principal headings of "Rotary" and "Cable." In the column headed "Length," the depths of all water strings have been classified in four groups, namely, those measuring 100 to 1000 feet, 1001 to 2000 feet, 2001 to 3000 feet, and 3001 feet and over. To the right of this column are other columns showing the diameters of nine different sizes of casing. The strings of 3-inch and 2-inch casing shown under Section 8, T. 3 S., R 9 W., S. B. B. & M., Table I, are not included. The number of water strings landed by either tool, in any field, for each depth group are shown in these columns. The small letter appearing at the right of each number signifies the method of shut-off, whether cement (c) or formation (f). The data of this further classification will be discussed later under method of shut-off.

<sup>1</sup>Second Annual Report, Bull. 82, Cal. State Min. Bur.—Sunset field—pp. 234 to 239.

TABLE VII. Showing Depths and Diameters of Casing Landed for Water String by Rotary or Cable Tools; Also Method of Shut-off, Formation (f), or Cement (c).

DISTRICT No. 1 (Los Angeles and Orange Counties).

Fields	Method of drilling	Length of casing, feet	Diameters of casing								Totals		
			12½ in.	12½ in.	11½ in.	11 in.	10 in.	9½ in.	8½ in.	6½ in.	4½ in.	Rotary	Cable
Coyote Hills	Rotary	100-1,000											
		1,001-2,000											
		2,001-3,000					7c						
	Cable	3,001+					4c		1c	2c		14	
		100-1,000											
Montebello	Rotary	1,001-2,000											
		2,001-3,000											
		3,001+											
	Cable	100-1,000											
		1,001-2,000											
Whittier, Puente, Olinda, Brea Canyon, Newhall	Rotary	2,001-3,000											
		3,001+											
		100-1,000											
	Cable	1,001-2,000											
		2,001-3,000											

TABLE VIII. Showing Depths and Diameters of Casing Landed for Water String by Rotary or Cable Tools; Also Method of Shut-off, Formation (f), or Cement (c).

DISTRICT No. 2 (Ventura County).

Fields	Method of drilling	Length of casing, feet	Diameters of casing								Totals		
			15½ in.	12½ in.	11½ in.	11 in.	10 in.	9½ in.	8½ in.	6½ in.	4½ in.	Rotary	Cable
Ventura, Ojai, Santa Paula, South Mountain, Sespe, Bardsdale, Simi, Piru.	Rotary	100-1,000	1c										
		1,001-2,000											
		2,001-3,000											
		3,001 +											
	Cable---	100-1,000	1c	3f, 9c			7f, 4c	3f	2f, 1c				1
		1,001-2,000		3c			3c		1c				
		2,001-3,000					2c		1c				
		3,001 +							1c				

TABLE IX. Showing Depths and Diameters of Casing Landed for Water String by Rotary or Cable Tools; Also Method of Shut-off, Formation (f), or Cement (c).

DISTRICT No. 3 (Santa Barbara, San Luis Obispo and Santa Clara Counties).

Fields	Method of drilling	Length of casing, feet	Diameters of casing								Totals		
			15½ in.	12½ in.	11½ in.	11 in.	10 in.	9½ in.	8½ in.	6½ in.	4½ in.	Rotary Cable	
Arroyo Grande, Casmalia, Cat Canyon, Santa Maria.	Rotary	100-1,000	1c										
		1,001-2,000		1c			4c						
	Cable	2,001-3,000				1c	6c		2c				15
		3,001+											
		100-1,000	2c	7f, 15c			6c		2c				
		1,001-2,000		22c			19c		2c				
		2,001-3,000	1c				1c		3c	2c			
		3,001+							8c	7c	1c		97

TABLE X. Showing Depths and Diameters of Casing Landed for Water String by Rotary or Cable Tools; Also Method of Shut-off, Formation (f), or Cement (c).  
DISTRICT No. 4 (Kern County).

Fields	Method of drilling	Length of casing, feet	Diameters of casing							Totals			
			15½ in.	12½ in.	11½ in.	11 in.	10 in.	9½ in.	8½ in.	6½ in.	4½ in.	Rotary	Cable
Lost Hills, Belridge, McKittrick	Rotary	100-1,000		37c			2c						
		1,001-2,000											
		2,001-3,000											
		3,001+											
	Cable	100-1,000		1f, 4c	3c		7f, 32c		1c			40	
Midway		1,001-2,000		1c			2c						
		2,001-3,000					1c						
		3,001+											
	Rotary	100-1,000			1c								
		1,001-2,000		1c		17f, 2c	1f, 11c		4c				
Summit		2,001-3,000							1f, 16c				
		3,001+		3f, 19c	1c		14c		6c			102	
	Cable	100-1,000		5f, 9c			1f, 2c		2c				
		1,001-2,000					3f, 15c		2c	1c			
		2,001-3,000					1f		9c	2c	1c		
Kern River		3,001+							3c	5c			
	Rotary	100-1,000		3c			2c						
		1,001-2,000		12c		1c	4c		2c				
		2,001-3,000				3c	1f, 9c		5c				
		3,001+							2c			44	
Kern River		100-1,000			1f		1f, 1c		1f				
	Cable	1,001-2,000		1f, 6c			4c		1f				
		2,001-3,000							1f, 8c	5c	1c		
		3,001+							1c	1c			
		*100-1,000		3f	10f, 3c		5c	2f, 1c	1f				
		1,001-2,000							1c				
		2,001-3,000							2c				
		3,001+							2c				
													81
													84
													83
													*30

\*Also 3 strings 7½-inch formation shut-off between 100 and 1000 feet.

One rotary job, 10-inch, cemented between 2001-3000 feet.



TABLE XII. Tools, Length and Diameter of Casing, Method of Shut-off.

All districts. All fields.

Diameter	15½-in.		12½-in.		11½-in.		11-in.		10-in.		9½-in.		8½-in.		6½-in.		4½-in.		Totals
	Rotary	Cable	Rotary	Cable	Rotary	Cable	Rotary	Cable	Rotary	Cable	Rotary	Cable	Rotary	Cable	Rotary	Cable	Rotary	Cable	
Lengths -																			
100-1,000	3c	4c	40c	18f 53c		11f 7c			16f 55c		5f 1c			11f 13c		3f		1f	65f 161c
1,001-2,000		1f	31c	7f 51c			2c		1f 51c		1c					2c			16f 227c
2,001-3,000			10c				17f 13c		4f 95c					1f 23c				2c	21f 219c
3,000+									19c	1c				10c	44c	2c	33c	3c	113c
Rotary totals	3c		81c				17f 16c		5f 172c				1f 40c						23f 315c
Cable totals		1f 4c	25f 104c		11f 7c				23f 122c		5f 2c			13f 130c		3f 47c		1f 5c	83f 421c
Total rotary and cable	1f 7c	25f 155c	11f 8c	17f 16c					25f 294c		5f 2c		11f 17c		3f 49c		1f 5c		105f 739c

Relative to the use of long water strings, Table VII shows that in the Coyote Hills field there were seven strings of 10-inch casing cemented, after landing with rotary, between depths of 2001 and 3000 feet, and four strings were cemented at depths greater than 3000 feet. There were no 10-inch water strings landed with cable tools. However, there were 15 strings of 8½-inch casing landed with cable tools and cemented at depths greater than 3000 feet. Table X shows that in the Midway field 17 strings of 11-inch were landed with rotary for formation shut-off, and two strings were cemented, between depths of 2001 and 3000 feet. No 11-inch water strings were landed with cable tools. It shows that three shallow shut-offs were made with cable tools between depths of 100 to 1000 feet. No 10-inch casing was landed with rotary between these shallow depths. On the other hand, the rotary landed three strings of 10-inch for formation shut-off and 25 strings for cement shut-off, between depths of 2001 and 3000 feet. A single string of 10-inch was landed for formation shut-off with cable tools between these depths. There were 14 strings of 10-inch casing landed with rotary and cemented at depths greater than 3000 feet. There were no 10-inch water strings landed with cable tools at depths greater than 3000 feet.

Table XII gives a recapitulation of data in Tables VII to XI, inclusive, and further illustrates the condition referred to above. The data have been rearranged so as to make direct comparisons, for each diameter of casing, to determine which tool landed the greater number of strings in each of the four depth-groups chosen. The blocks of dark figures indicate the predominating method of drilling for the respective depths and diameters of casing.

A study of Table XII reveals the following interesting features:

- (1) The 10-inch casing is the predominating favorite for water strings landed with rotary tools. In fact there were more 10-inch water strings (177) landed with rotary than any other single size casing with either rotary or cable tools.
- (2) With respect to diameters, which control the maximum size of bit to be used in further drilling, the diameter of 10-inch is the exact mean of the largest and smallest diameters in common use, namely, 15½-inch and 4½-inch.
- (3) The number of 12½-inch, 10-inch and 8½-inch water strings landed with cable tools is almost evenly distributed among the three sizes, respectively, 129, 145 and 143.

The rotary method is specialized to long water strings of a limited range of diameters. The range for cable tools is much more elastic. In recent years the rotary method has been used to a large extent by operators or contractors, who engage to land two or three thousand feet of a certain diameter of casing for water shut-off. Economically—both

as to cost and time of drilling—there can be no criticism of such procedure, providing the primary principles of protection and conservation are not disregarded. The preceding evidence and data show that, in order to meet these requirements, there is a real necessity for change and improvement in present methods of attempting to land water strings with rotary in narrow and more or less speculative margins of safety.

### **Method of Shutting Off Water.**

The principal methods of shutting off water in oil wells in California were described in the Second Annual Report.<sup>1</sup> Only the methods shown under the heading "Shut-off" in Tables I to V, pp. 148-195, will be discussed in this paper. The main classifications are formation shut-offs and cement shut-offs.

Formation shut-off is the term applied to the operation of excluding water, where casing, with a plain shoe, is landed or driven into a stratum of shale or clay using no artificial bond.

Cement shut-off is the term applied to the operation of excluding water, where hydraulic cement is used to form a bond between the casing and the formation in which the shoe of the casing is landed or driven.

### **Formation Shut-off.**

Of 841 shut-offs for which data of the method are available 105 or 12.5 per cent were formation shut-offs. Of these shut-offs 62 per cent were made at depths between 100 and 1000 feet, 16 per cent were made at depths between 1001 and 2000 feet, 22 per cent—which, however, includes 17 shut-offs with 11-inch casing and 4 shut-offs with 10-inch casing; see Table X, Midway, Sunset fields—were made between depths of 2001 and 3000 feet. There were no formation shut-offs made at depths greater than 3000 feet. Only 11 per cent of the formation shut-offs were failures.

In the case of the above-mentioned shut-offs with 11" and 10" casing between depths of 2001 and 3000 feet, which were made by a single company, a study of Table XII shows that there were only three other formation shut-offs made between these depths. The case is mentioned because, aside from the operations of this company, formation shut-offs between these depths are uncommon. Only one other water string in the 841 jobs listed was landed for formation shut-off with rotary. There has been some question as to the efficacy of this practice. The results of test show that only 2 of the 21 jobs were failures. This is a little over 9 per cent. It is 3 per cent less than the failures for 65 formation shut-offs between depths of 100 and 1000 feet.

<sup>1</sup>Methods of Shutting Off Water. Bull. 82, Cal. State Min. Bur. pp. 38-43.

It must be noted, however, that this operation would be practicable only in an area, such as this one, where formational conditions are exceptionally favorable and thick beds of shale give the necessary leeway for successful landing of water string with rotary.

For example, the following is a portion of the log of a well in this area<sup>1</sup> which aptly illustrates the advantageous conditions for formation shut-off:

11-inch, 47-pound casing landed at 2255 feet.

Water logged at 550 to 560 feet.

Depth to		Thickness	Name of formation
Top of formation	Bottom of formation		
1,925	2,025	100	Clay and shale.
2,025	2,075	50	Clay.
2,075	2,150	75	Blue shale, little gas.
2,150	2,200	50	Clay.
2,200	2,230	30	Blue shale.
2,230	2,240	10	Clay.
2,240	2,250	10	Shale.
2,250	2,255	5	Blue clay—11 in., landed 2,255 ft.
2,255	2,364	109	Blue shale.
2 3/4	2,376	12	Sandy shale—gas.

The foregoing shows a range of over 400 feet of formation, almost any part of which would be suitable for formation shut-off. It may be added that the same character of formations are shown in this log from a depth of 1450 feet to the depth at which the above record begins. For the immediate purpose of excluding water at the shoe, the formation shut-offs, referred to above, give satisfactory results at test.

The percentages of formation shut-offs, made between various depths, have already been given. In Table XIII the percentages of failures of formation shut-off for the several depth groups, previously used in this paper, are shown. Possibly more accurate representation could be based on a segregation by frictional depths, that is, length of water string in contact with formation, either to the surface, where no other casing has been used, or to the shoe of the next larger conductor casing.

This table shows the total successes and failures for both formation and cement shut-off. It shows the gross percentage of failures for each method of shut-off and the average percentage for both methods. It also shows the number of successes and failures for each method of shut-off under segregation of (1) water strings landed with cable tools and (2) water strings landed with rotary tools.

Formation shut-offs are restricted to the shallower wells. Dead-weight of casing and formational friction prevent successful driving in deep holes. Comparison of data in Table XIII shows a smaller percentage of failures for formation than for cement shut-offs. In making

<sup>1</sup>See Table IV, Sec. 35, T. 31 S., R. 23 E., Sec. 9, T. 32 S., R. 24 E., M. D. B. & M.

formation shut-off the time of idleness and expense incident to a cementing job are greatly reduced or even eliminated. On the other hand, it is probable that cement jackets or thick mud around water strings will insure greater life to the casing through protection from corrosion.

The subject of corrosion of water strings in formation shut-offs deserves serious consideration. The operator should determine the corrosive properties of the water to be excluded before a final drilling program is adopted. For example, Deputy Supervisor Kirwan,<sup>1</sup> when at Coalinga, reported an extremely corrosive condition as follows:

"Four wells surrounding Traders Oil Co. well No. 41 show an average production of 35% emulsion and water. Mr. McQuigg's<sup>2</sup> letter dated Jan. 31, 1917, states that water eats out the casing in from three to five years duration and requires replacing."

Mr. Kirwan suggested that this condition could be overcome by cementing water string with the Perkins or any system that will force cement back of the pipe, for a cement jacket, to top of the well.

In the First Annual Report<sup>3</sup> the writer noted a number of instances of failure from corrosion. In five wells in the Pinal Dome-Hobbs area, Santa Maria field, top water ate through two strings of casing, 12½-inch and 10-inch, in each well, in an average time of six years. These were formation shut-offs.

#### **Cement Shut-off.**

Cement is used in shutting off water for the primary purpose of making an impervious bond between the foot of the water string and formation in place. There are a number of secondary purposes, for which varying amounts of cement, in excess of the quantity sufficient for excluding water at the shoe, are placed back of the casing. The principal secondary purposes are the following:

- (1) Cement jacket around casing to prevent corrosion.
- (2) Cement jacket around casing to reinforce same against collapse.
- (3) Cement seal, filling space between outside of casing and wall of hole, to prevent movement of all fluids or gases from their native strata into other susceptible strata exposed by the drill.
- (4) Cement seal, filling space between outside of casing and wall of hole, to prevent the expulsion of mud fluid from porous formations into which it has been placed under pressure for the purpose of rendering said formations impervious to movement of water, oil or gas.

The cement jacket to prevent corrosion has already been mentioned under formation shut-off. The practice of pumping large quantities

<sup>1</sup>Kirwan, M. J.—Letter in Departmental files relative to method of shut-off in Traders Oil Company Well No. 41, Sec. 24-26-14, Coalinga field, February 2, 1917.

<sup>2</sup>McQuigg, M. V., President, Traders Oil Co.

<sup>3</sup>First Annual Report—Bull. 73, Cal. State Min. Bur. p. 202.

of cement back of a string of casing for the purpose of reinforcement is quite general, although one or both of the purposes, mentioned under 3 and 4 above, are usually part of the operator's object. The variety of purposes and results dependent upon these secondary, and often interlocking, mudding<sup>1</sup> and sealing operations presents problems of a nature and magnitude not within the scope of the present discussion. Comments on reports of proposed operations<sup>2</sup> No. P 3-40, P 3-39, and P 3-26 show a few instances in which sealing operations were recommended. The results of these operations are still a matter for future determination. It is the writer's opinion that sealing, with cement alone, should only be attempted in shale bodies, or other formations of a similarly rigid nature. It is almost impossible to place a cement plug in sand, or other unstable formation, in open hole. Such conditions for a cement seal would be even less favorable.<sup>3</sup>

#### Amount of Cement.

In the operations studied there is a wide range in the quantity of cement used. In the Midway field 650 sacks of cement were used in Well No. 21 of the St. Helens Petroleum Company, Ltd. (Table IV, Sec. 16, T. 32 S., R. 24 E.). The length of this water string was 2296 feet. The amount of cement used should have been sufficient to reach to the surface.<sup>4</sup>

Report No. T 4-1266 shows that the General Petroleum Company, operating in Sec. 2, T. 29 S., R. 21 E., Belridge field, made a water shut-off for prospecting purposes, in well No. 141, with 5 sacks of cement. Table IV shows that a number of similar shut-offs were made by this company. This method of shut-off is part of a systematic program of prospecting and testing formations. There are a number of tar and water sands overlying the productive oil zone in this area. These strata are apparently lenticular and some of the tar lenses carry water. Under these conditions it has been found impracticable to use cross-sectional correlations for anything further than a rough estimate for the depth to shut-off water. In the event that water formations are entered below the shoe, after a prospect shut-off is made, the water

<sup>1</sup>See report on "Use of Mud-laden Fluid, pp. 77 to 106.

<sup>2</sup>See List of Decisions, Santa Maria Field, Sec. 26, T. 9 N., R. 24 W., and Los Almos Rancho.

<sup>3</sup>Well No. 6-D, Belridge Oil Co., Sec. 33, T. 28 S., R. 21 E., covered by Report No. T 4-768 gives an instance of probably successful cement seal. Water flowed between 6½ in. and 8½ in. casings before cementing. After cementing both casings remained full of water, but with no movement.

<sup>4</sup>The Standard Oil Co. is quoted in Report No. P 4-1161 to the effect that the 6½ in. and 8½ in. casings were cemented together in Spreckles Well No. 2, Sec. 16, T. 30 S., R. 22 E., McKittrick field. The 8½ in. casing was landed at 2200 ft., the 6½ in. casing was cemented 3032 ft.; 832 ft. open hole, with 80 sacks cement, Perkins process. The C. C. M. O. Co. in working on Well No. 26, Sec. 8, T. 32 S., R. 23 E., Midway field, found the 10 in. and 12½ in. casings cemented together. The cement came to a depth of 11 ft. below surface. (Top of 12½ in. casing.) Top joint of 10 in. could not be unscrewed on account of cement. The 12½ in. casing was 741 ft. long. The 10 in. casing was cemented at 1075 ft. with 160 sacks fast setting cement, by Huber & Wilson.

string is pulled up and carried below the sand for another shut-off. B. E. Parsons, geologist of the company, states that in nearly fifty of these operations there have been only two cases in which they were unable to remove the shoe-joint intact. In some cases no greater quantity of cement is used for a permanent shut-off. Water is excluded, however, by a sort of combination cement and formation shut-off. For example, reports No. T 4-1328 and No. T 4-1169 show that for two such jobs 6 sacks and 12 sacks of cement, respectively, were placed with dump bailer. The cement fluid was mixed as thick as it could be handled. The shoe was then driven into a few feet of small hole. When tar sands were excluded by the water string in the above operations they were mudded under pressure before cementing. Formation shut-off, using mud fluid also, is being used for prospecting purposes, in the Casmalia field, as shown by reports No. P 3-193, P 3-192 and T 3-127.<sup>1</sup> A shut-off for prospecting purposes (Report T 4-623) was made by the California Midway Oil Company in well No. 8, Sec. 32, T. 31 S., R. 23 E., Midway field. The 6½-inch casing was cemented at 3185 feet in blue clay with 5 sacks of cement, using dump bailer. Later the company pulled the casing loose and carried it to a depth of 3425 feet.

#### Depth of Cementing.

It has already been noted that formation shut-offs are limited to comparatively shallow wells. There is no such limit for cement shut-offs although failures appear to increase with depth. Of 736 cement shut-offs shown in Table XIII, there were 25 per cent made between depths of 100 to 1000 feet, 30 per cent between depths of 1001 to 2000 feet, 29 per cent between depths of 2001 to 3000 feet, and 16 per cent at depths greater than 3000 feet. The proportion of failures for cementing at these depths is 14.9, 17.5, 18.3 and 20.4 per cent, respectively. However, there is a notable difference in cementing after cable and rotary landings at these different depths. In each instance the percentage of rotary failures is greater. The average excess of rotary failures for all depths is 7 per cent. The details of these percentages are shown in the two columns in Table XIII, in dark-face figures, under the headings Cable and Rotary.

#### Method of Cementing.

There are five principal methods of cementing noted in a study of the reports. These are dump bailer, Huber & Wilson, Perkins, Scott, and tubing. There are a number of variations in application of each of these methods depending upon mechanical and formational condi-

<sup>1</sup>See List of Decisions, Casmalia field, Doheny-Pacific Petroleum Co. Lease No. 1, Lease No. 2. Also Report on Casmalia field operations, p. 364.

tions at the well. Some operators use their own crews and do their own cementing either by dump bailer, tubing, or a variation—and the forerunner—of the Perkins method, without plugs. Most operators, however, prefer to engage a specialist in cementing oil wells because he appears at the well with the necessary equipment for mixing the cement and placing it in the well. The operator furnishes the water and cement and usually the crew, with the exception of one or two operatives of the cementing company who man the pumps and other equipment and place the cement.

**TABLE XIII.** Shows Percentage of Failures for Both Methods of Shut-off for Various Depth Groups and Also Segregates Failures as Between Rotary and Cable Tools on the Same Basis.

Shut-off, depth and method	Success	Failure	Total	Percentage failures	Cable landing			Rotary landing		
					Success	Failure	Percentage failure	Success	Failure	Percentage failure
100-1 000—										
Formation	57	8	65	12.3	57	8	12.3			
Cement	154	27	181	14.9	114	19	14.3	40	8	16.7
Totals	211	35	246	14.2	171	27	13.6	40	8	16.7
1 001 2,000—										
Formation	15	1	16	6.2	14	1	6.7	1		
Cement	184	30	223	17.5	107	22	17.0	77	17	18.1
Totals	199	40	239	17.4	121	23	16.0	78	17	17.9
2 001 3,000 -										
Formation	22	2	24	8.3	2			20	2	9.1
Cement	179	40	219	18.3	70	8	10.2	109	32	22.7
Tota's	201	42	243	17.3	72	8	10.0	129	34	20.8
3,001 + --										
Formation										
Cement	90	23	113	20.4	67	15	18.3	23	8	25.8
Tota's	90	23	113	20.4	67	15	18.3	23	8	25.8

No detailed description of the various methods will be given in this discussion. F. B. Tough<sup>1</sup> has covered the subject in considerable detail. His report, in addition to the descriptive matter and discussion of advantages and disadvantages of various methods, contains numerous illustrations and diagrams.

There are at least three kinds of dump bailer in common use for cementing. The kind to be used is indicated by depth and diameter of hole and amount of cement to be placed. The amount of cement that can be placed for cementing a water string varies from 5 to 70 sacks. The use of dump bailer is more applicable to shallow shut-offs.

The distinctive feature of the Huber & Wilson method is the addition of a chemical solution, formula a secret, to the cement fluid which

<sup>1</sup>Tough, F. B.—Method of Shutting-off Water in Oil or Gas Wells. Bull. 163, U. S. Bureau of Mines.

induces quick setting. The cement is pumped either through the casing or tubing, depending upon circumstances.

The Perkins Process comprises a patented feature of wooden plugs which are placed in the casing, one going ahead and the other following the cement fluid as it is pumped. The first plug lodges in the bottom of the casing, which is lifted off bottom while pumping cement. When sufficient water, which follows the second plug, is pumped into the casing to displace the cement fluid the two plugs come together at bottom. There is a disk of rubber belting attached to the second plug and fitting the casing snugly. This disk acts as a valve and stops further circulation after the plugs come together. Two plugs are not always used. Report No. P 3-56, listed under Decisions, Casmalia field, Doheny Pacific Petroleum Company, well No. 1, Lease 2, gives the details of the various steps in a shut-off job by the Perkins Cementing Company.

The distinctive feature of the Scott method is a specialization, covered by patent, of the tubing method of cementing. The patent covers a casing head packer, with relief port, for use with tubing in pumping cement back of the casing. If necessary the cement fluid, in tubing and casing, can be displaced with water through this port. In the Scott process the cement is mixed in a hopper alongside the pump. Cementing is done by Scott, however, without the use of tubing. In fact, tubing is used only in cable-tool holes with short friction where there is no danger of freezing casing. In rotary jobs the cement is pumped through the casing and is displaced from the casing by following it with mud-fluid.

In the tubing method the cement is pumped to the bottom of the hole, and behind the casing, with a string of tubing. Sometimes a casing packer is placed near the bottom of the tubing for the purpose of directing all cement fluid back of the casing. In other jobs the tubing is set in a casing head packer. In the latter case the hole is completely filled with water to prevent return of cement fluid into casing. There is danger in the tubing method of not being able to pull tubing before cement starts to set.

The dump-bailer method was used in 106 shut-off operations and 86 of these were performed at depths between 100 to 2000 feet. Table XIV has been prepared to show the relative number of shut-offs attempted by each method of cementing. These data are also segregated by methods of drilling. The last column shows the percentage of work, out of 702 operations, for each method. The percentages shown, under total, at the foot of the table confirm previous statements as to the excess of rotary failures, namely, 7 per cent, over those of Cable tool drilling.

TABLE XIV. Method of Cementing and Tools Used.

Name of method	Cable				Rotary				Total wells cemented				Percentage work each method of cementing
	Total	Success	Failure	Percentage failure	Total	Success	Failure	Percentage failure	Total	Success	Failure	Percentage failure	
Dump bailer	94	82	12	13	12	10	2	17	106	92	14	13	15
Huber & Wilson	33	27	6	20	12	7	4	33	45	35	10	22	6
Perkins	206	167	39	19	234	183	51	22	440	350	90	20	53
Scott	18	16	2	11	18	16	2	11	36	32	4	11	5
Tubing	51	42	9	18	24	21	3	13	75	63	12	16	11
Totals	402	334	68	14	300	238	62	21	702	572	130	18	100

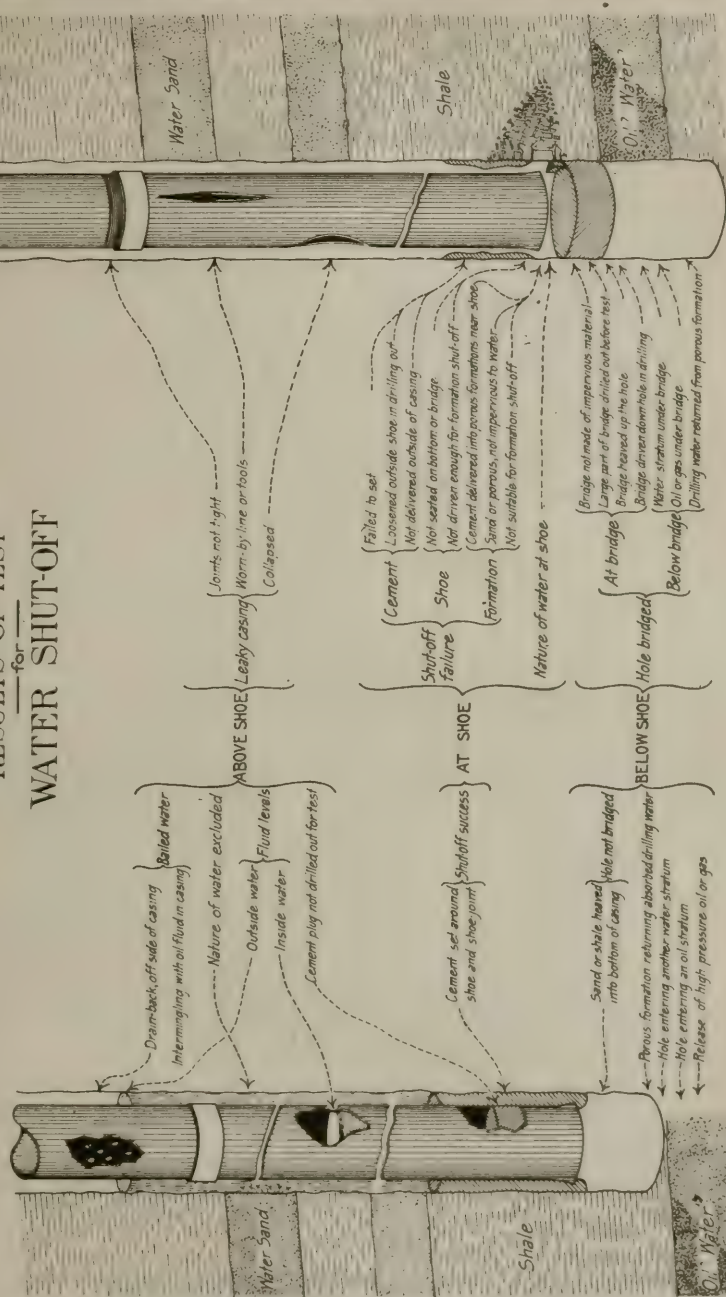
The depths of hole, formational conditions, pressures and methods of drilling should control to a great extent the method of cementing to be used. The depths, already mentioned, for which dump bailer is used, and the percentage of failures shown in Table XIV indicate that the limitations of this method have been fairly well determined. The failures for the Perkins method are higher than the average for all methods. The Perkins method was used in 63 per cent of all operations, and 78 per cent of the rotary operations, listed in Table XIV.

Although one of the largest companies in the state contracts all of its cementing operations by this method, and a number of other companies use the method almost exclusively, it is probable that in a number of instances some other method, such as dump bailer or tubing, would have given better results.

No matter how efficient or expedient a method of cementing may appear, it is the history of oil well operations that each new well presents a new combination of formational and mechanical conditions. It is hardly possible, therefore, to conceive of a method, almost automatic in so far as the attention of the operator is concerned, which can be applied efficiently in all cases. Results show that operators should make a more careful determination of the method of cementing necessary.

The tubing method appears to be quite efficient for shut-offs on rotary jobs. In the 24 rotary shut-offs listed, 23 were made at depths greater than 2000 feet. Results for the Huber & Wilson and Scott methods, although listed, possibly do not warrant conclusions because of the relatively small number of operations performed.

# FACTORS —of— RESULTS OF TEST —for— WATER SHUT-OFF



Colorado State Mining Bureau

Accompanying Bulletin, 1908-4

FIG. 7.

### FACTORS OF RESULTS OF TEST FOR WATER SHUT-OFF.

The results of test for water shut-off, as between success or failure in excluding water, have been used in this discussion as the basis of conclusions regarding the relative efficiency of the principal methods of drilling wells and shutting off water. Details of results of test are listed in tables I to V inclusive under the headings *Success* and *Failure*. A study of these details will show that it is often necessary to identify a number of factors, such as drilling water, fluid levels, heaving formations, plug in casing, etc., before a definite statement can be made as to whether or not water is excluded at the shoe of the water string.

The most positive result of test is one in which, if the hole is bailed dry, it remains dry for the period of test; or, if it is bailed to a certain fluid level, there is no change in the fluid level during the period of test; or, if water appears, the water is known to be coming into the hole around the shoe of the water string. The details of results already mentioned will show that such ideal tests are in the minority. Usually other extraneous factors appear in the result of the test or inspection incidental thereto.

The factors have been divided by the writer into three groups, as follows:

- (1) Above the shoe.
- (2) At the shoe.
- (3) Below the shoe.

The diagram, Figure 7, on page 135, illustrates the arrangement of the various factors under each group. These will be discussed briefly, beginning with the group of factors above shoe.

#### Factors Above Shoe.

One of the factors above the shoe is that of water entering the well through leaky casing. Leaks in the water string are due to insufficient tightening of joints, collapse, or line wear—the last mentioned, rarely.

A good example of leak in water string, due to insufficient tightening, is covered in report of test at a well of the Associated Oil Company,<sup>1</sup> Casmalia field. At the time of the first test water was entering the well from an undetermined source. The company ran a casing tester and found casing leaking at the rate of 670 gallons per day. The casing—960 feet long—was screwed up 26 inches. After the casing was tightened, the tester, when run to former depth, showed one pint of water in one-half hour. The size of the casing was 12½-inch, 40-pound.

In well No. 38 of the Shell Company, Coalinga field,<sup>2</sup> test of 10-inch, 40-pound, water string showed 156 feet of water in 26½ hours. A

<sup>1</sup>Decisions, Casmalia field. Associated Oil Co.—Punta de la Laguna Well No. 4—Morganti, shut-off, T 3-114.

<sup>2</sup>See Decisions, Coalinga field. Shut-off T 5-203, Sec. 14, T. 19 S., R. 15 E.

casing leak was found at a depth of 230 feet. The casing—1925 feet long—was screwed up  $10\frac{1}{2}$  inches, and test then showed 25 feet water in 16 hours.

It is probable that this factor could have been more easily determined by bailing the casing to a safe depth before the cement was drilled out. A pressure test inside the casing will not prove as conclusively as bailing whether or not the casing is tight, because it is possible to sustain pump pressure against a number of small leaks.

Casing quite frequently collapses as the result of injudicious bailing. Any extensive tests to determine that a water string has collapsed are seldom necessary. In fact, when there is such a condition, unless it appears feasible to swage the casing, the well never comes to a test. Collapse of unsafe lengths of  $12\frac{1}{2}$ -inch, 40-pound casing has been noted most frequently. It is also noted that the collapsing strength of  $12\frac{1}{2}$ -inch, 40-pound casing is 500 pounds per square inch (*see* Table XV), the lowest collapsing strength of any size or weight of casing in common use.

For example: the Doheny-Pacific Petroleum Company<sup>1</sup> in the Casmalia field lost a string of  $12\frac{1}{2}$ -inch, 40-pound casing through collapse. The casing was originally cemented at 1803 feet, and collapsed at 1440 feet upon bailing. In well No. 1, Quintero, of the Union Oil Company,<sup>2</sup> a water string of  $12\frac{1}{2}$ -inch, 40-pound casing collapsed, after cementing and bailing, at about 1200 feet. The casing was swaged, but did not exclude water. In Darlington well No. 1 of the Petroleum Midway Company<sup>3</sup> a string of  $12\frac{1}{2}$ -inch, 40-pound casing was cemented at a depth of 1821 feet. Upon bailing to a depth of 1380 feet for test of water shut-off, the casing collapsed at a depth of 1500 feet. Because of the excessive lengths, nothing other than collapse should have been expected in the three cases mentioned.

In order to overcome conditions such as the foregoing, where a long string of large size casing seems necessary, it is better practice<sup>4</sup> to use two weights of casing, putting the heavier weight casing on bottom. There appears to be no well defined rule as to the ratio of combination of the two different weights.

Table XV, giving the depths of water exerting pressure enough to collapse, for various diameters and weights of casing, is taken from the First Annual Report.<sup>5</sup> A factor of safety of at least 2, that is, dividing the figures in the last column of the table by 2, is recommended.

<sup>1</sup>Decisions, Doheny-Pacific Petroleum Co. Shut-off, Report No. 3-25, Well No. 8, Soladino lease, Casmalia field.

<sup>2</sup>Decisions, Casmalia field, Union Oil Co., Quintero, Well No. 1, Shut-off, T. 3-42.

<sup>3</sup>Decisions, District No. 1, Montebello field, Sec. 31, T. 1 S., R. 11, P. 1-279.

<sup>4</sup>See Table V, Sections 14, 26 and 27, T. 19 S., R. 15 E.

<sup>5</sup>First Annual Report—R. P. McLaughlin, Bull. 73, Cal. State Min. Bur. p. 223.

TABLE XV.

Size of casing (nominal)	Weight per foot, pounds (nominal)	Collapsing strength, pounds per square inch	Depth of water exerting pressure enough to collapse casing (feet)
4 1/4-inch	16	4,715	10,880
4 1/2-inch	13	2,900	6,700
4 3/4-inch	15	3,605	8,320
5 5/8-inch	20	3,295	7,620
6 1/4-inch	20	2,345	5,420
6 1/2-inch	24	3,215	7,420
6 3/4-inch	26	3,650	8,420
6 7/8-inch	28	4,080	9,420
6 5/8-inch	20	1,980	4,570
6 3/8-inch	26	3,075	7,080
6 1/8-inch	28	3,490	8,060
6 3/16-inch	30	3,850	8,900
7 1/8-inch	26	1,945	4,480
8 1/4-inch	28	1,680	3,840
8 3/4-inch	32	2,150	4,960
8 1/2-inch	36	2,635	6,080
8 1/4-inch	38	2,880	6,640
8 3/8-inch	43	3,510	8,100
9 5/8-inch	33	1,285	2,970
10-inch	40	1,425	3,290
10-inch	45	1,795	4,140
10-inch	48	2,025	4,620
10-inch	54	2,510	5,800
11 5/8-inch	40	835	1,920
12 3/8-inch	40	500	1,150
12 1/2-inch	45	750	1,730
12 3/4-inch	50	1,010	2,330
12 1/2-inch	54	1,215	2,800
13 1/4-inch	50	650	1,500
15 1/2-inch	70	795	1,940

Some operators follow a policy, rather strenuous at times, of bailing a water string to bottom, regardless of the lowest probable depth to which fluid will be reduced during the life of the well. If conditions, such as danger from collapse, or heaving sands, or gas strata of high pressure, prohibit bailing dry, the well should be bailed to a depth at which there is several hundred feet difference between fluid levels inside and outside the casing. It is advantageous, for this reason, if for no other, to carefully record the fluid levels of water strata encountered in drilling. It is difficult to make such observations in a rotary hole. In the last column of Table IV are shown a number of instances in which fluid was bailed to a depth less than total depth to shoe. In each of these instances it was necessary for the inspector to satisfy himself that the depth bailed was greater than fluid level of water excluded.

One of the commonest sources of small quantities of water in a well at the time of test is the minor feature called "drain-back." Drain-back is due to gravitation of water from bailed fluid sprayed onto the sides of the casing from leaky or gassing bailers, during preparation for test. It is difficult to compute the maximum amount of water

allowable for drain-back. It depends upon such features as condition of bailer and fluid, diameter and depth of casing. The following instance<sup>1</sup> will suffice, as one of many, for an example. A well in the Lost Hills field was bailed dry for test. At the end of 17 hours 10 feet of water had collected in the bottom of the hole. This was attributed to drain-back.

Besides spraying onto the sides of the casing, bailed water commonly intermingles with oil, when present, and is held in suspension. It is sometimes necessary to thief the fluid, at increasing depths, to bottom and make centrifuge tests in order to determine whether or not there has been a change in the water content of fluid.

This is illustrated in the following comments on test at M/C Well No. 37 of the Standard Oil Company, in Coyote Hills field.<sup>2</sup> On account of mixture of oil and water results of bailing tests at successively lower depths did not show sufficient information to warrant a conclusion. Further tests at a later date were made. Oil and water were still considerably mixed. From the results it was not possible to conclude whether or not water contents of fluid had increased. Well was passed for pumping test and at end of 30 days the well produced only 0.4 per cent water.

Another example is given in Report No. T 1-208 for Well No. 42 on the same property. The observations, taken from Deputy Supervisor Kirwan's report are as follows:

"All free water had been bailed out. During the test the oil in the well stood near the surface. Samples of fluid from various depths showed a small amount of water and emulsion by centrifuge test. Approval to continue drilling was given. Recommended production test after completion."

It is advantageous to know the *nature* of the water excluded as well as the fluid level. The advantages of chemical analyses of waters have already been mentioned in the discussion of the formation shut-off. There are other familiar advantages not within the scope of this discussion.<sup>3</sup> With reference to results at test, an elementary knowledge of the nature of the water excluded, such as whether it was fresh water, brackish, salt or sulfur, is often sufficient for the inspector to determine the source of a water which may be present.

<sup>1</sup>Decisions—Lost Hills field. Sec. 29, T. 26 S., R. 21 E., M. D. B. & M. Associated Oil Co. Well No. 2-10. Shut-off. T 4-668.

<sup>2</sup>Decisions. Coyote Hills field. Sec. 18, T. 3 S., R. 10 W. Standard Oil Co. Well No. 37. Shut-off. Reports No. T 1-90, T 1-95 and T 1-190.

<sup>3</sup>Analyses of Water—Coalinga west side field. Bull. 73, Cal. State Min. Bur. pp. 85 and 86. Analyses of Water—Coalinga field. Bull. 69, Cal. State Min. Bur. p. 160. Analyses of Water—Casmalia field. Bull. 82, Cal. State Min. Bur. p. 206. Analyses of Water—Casmalia field; see Chapter V, p. 367, this report.

**Factors at Shoe.**

The factors at the shoe arise from failure to get a job. Such failures may be due either

- (1) to the nature of formations in which landing was made;
- (2) improper preparation of the hole for shut-off;
- (3) ineffective placing of cement.

In making a cement shut-off the cement may fail to set because of gas agitation or a continuance of fluid circulation after cementing. In order to keep the gas quiet, the maximum hydrostatic head possible is held in the casing after cement is placed. This will also prevent differential movements of cement fluid to a large extent.

For the purpose of neutralizing the supposed unfavorable chemical reactions between certain native waters and cement fluid, compounds such as bicarbonate of soda or hydraulic lime are put into the well ahead of the cement in some instances. The necessity of this practice is questionable.

An example of this practice is shown in shut-off operations of the Oak Ridge Oil Company<sup>4</sup> in the South Mountain field, Ventura County. In cementing a string of 12½-inch, 40-pound casing at 630 feet, the 75 sacks of cement used was preceded by 100 pounds of bicarbonate of soda.

A few companies in the state use hydraulic lime in cementing operations. The lime is supposed to perform a dual purpose. It is sent ahead of the cement and back of the casing in order to seal crevices and cleanse the exposed formations so that the cement can make better contact. It is also supposed to alter waters unfavorable to setting of cement and thereby hasten crystallization. There can be no chemical reaction between the lime and cement. The saturated solution of calcium hydroxide provided by the presence of the lime will facilitate the formation of calcium silicate crystals so as to make for improvement in the strength of the concrete. This, of course, applies to mixtures of lime and cement fluids.

Shertzer<sup>5</sup> gives the following typical composition of two hydraulic limes and also a typical cement:

	Lime No. 1	Lime No. 2	Cement No. 1
Insoluble residue .....	.62	2.39	1.00
Si O <sub>2</sub> .....	22.10	14.17	22.00
Al <sub>2</sub> O <sub>3</sub> .....	1.82	6.79	7.5
Fe <sub>2</sub> O <sub>3</sub> .....		2.34	3.5
Ca O .....	66.72	63.43	62.0
Mg O .....	1.17	1.54	1.0
SO <sub>3</sub> .....	.49	1.63	1.5
CO <sub>2</sub> .....	.64	3.64	.5
H <sub>2</sub> O .....	5.36	2.69	.5
Alkali and loss .....	1.08	1.33	.5

<sup>4</sup>Decisions—District No. 2, South Mountain field. Oak Ridge Oil Co. Well No. 5, Sec. 17, T. 3 N., R. 20 W., S. B. E. & M., Report T 2-530.

<sup>5</sup>Letter to the department from Tyrrell B. Shertzer, District Engineer, Hydrated Lime, Bureau National Lime Manufacturers Association, Pittsburgh, Pa.

The specific gravity of hydraulic lime is about 2.90 and weight per cubic foot about 43 pounds. The best hydraulic limes contain from 13 to 17 per cent of silica, alumina and iron oxide combined. The cementing index varies from .33 to 1.06.

In cementing oil wells any beneficial effects claimed for the lime must of necessity be limited. The lime fluid when pumped into the holes must displace the water around the shoe of the casing. The lime fluid is rapidly followed, and displaced, by the cement fluid. As a result of these direct displacement actions, rather than an intermingling of fluids, it is highly probable that the fluid which finally sets around the shoe of the water string, the most critical position of the shut-off, is unadulterated cement.

In a number of jobs covered in the listed results of tests the cement used was preceded by hydraulic lime. For example, in seven wells of the Doheny-Pacific Petroleum Company, in the Casmalia field, an average of 117 sacks of hydraulic lime to 171 sacks of cement was used. Report No. P 3-56, listed under Decisions of District No. 3<sup>1</sup>, gives the details of the various steps in a shut-off in which 60 sacks of hydraulic lime were pumped into the well preliminary to the usual cementing operations.

In this job 8½-inch, 28-pound casing was cemented in a 10-inch hole at 2453 feet. One sack of cement should fill 7.8 feet of hole. From the fact that there were complete fluid returns at the surface, during the operation, it is probable that when the plugs came together the cement fluid, containing 150 sacks of cement, filled not only the 543 feet of annular space between the casing and the 10-inch hole, but extended above the shoe of the 10-inch conductor casing. Such being the condition, the 60 sacks of hydraulic lime were probably placed in the space between the 10-inch and 8½-inch casings.

Most of the other items shown in the diagram under Factors at the Shoe, when the shut-off is a failure, are self-explanatory. However, the following notes from several reports will illustrate the more important features:

Shoe not set on bottom: In Well No. 6 of the Interstate Oil Company<sup>2</sup> there was a 180-foot rise in water at time of test. Shut-off was a failure. Measurements showed 5-foot plug in casing above shoe. Concluded shut-off failed because iron in bottom of hole prevented casing from seating at time of cementing.

Cement delivered into porous formation near shoe: In Well No. 14, Soladino<sup>3</sup>, the 10-inch casing was cemented with 100 sacks of cement.

<sup>1</sup>Decisions, District No. 3, Casmalia field, Doheny-Pacific Petroleum Co. Well No. 1, Lease 2.

<sup>2</sup>Decisions, Sunset field, Sec. 4, T. 11 N., R. 23 W., Interstate Oil Co. Well No. 6, Shut-off; Report T 4 676. Also Table IV.

<sup>3</sup>Decisions, Casmalia field, Soladino 1, sec. Doheny-Pacific Petroleum Co. Well No. 14. Drill: Report P 3 167.

Shut-off was tested and found satisfactory. Well was drilled into production and later showed water. Bridged under 10-inch casing and found water not shut off. Put a strain on 10-inch casing and pulled it loose. Shoe joint showed cement extended only four feet above the shoe. Concluded that cement fluid was pumped into fractured shale formation immediately adjacent to the shoe.

The courses open to the operator, when a shut-off fails, have already been mentioned under Methods of Drilling. They may be summarized as follows:

- (1) He may cut off the water string, redrill and make another shut-off at a higher, lower, or equal depth.
- (2) In the case of cement shut-off, he may attempt to re-cement, usually under pressure, or rip casing near shoe and force cement through rips.
- (3) If a formation shut-off fails he may drive the casing further, or jar it loose and drill deeper and drive for another attempt or, after loosing, cement with dump-bailer or other method at the same depth.
- (4) When the depth of failure is not close to oil-bearing formations he may prefer to drill ahead and cement another string of casing or a liner.

A study of the lists of decisions in the reports for the five districts will give numerous variations of methods employed where water shut-off was not successful. Operations at Baldwin Well No. 5<sup>1</sup> of Standard Oil Company in the Montebello field furnish a good example.

One method, re-cementing through tubing, is apparently not an efficient one. This statement is supported by data from the tabulation of the results of tests (see Table I, for Coyote Hills, Montebello and Whittier fields). Of seventeen jobs of re-cementing through tubing, under pressures varying from 500 to 1275 pounds per square inch, only one was successful. Table XI shows that these re-cementing jobs, and six other similar failures were not included in the data discussed under Methods of Drilling and Shutting-Off Water.

Ripping casing, to re-cement, was carried out to good effect by the Standard Oil Company<sup>2</sup> in Murphy-Coyote Well No. 36. The 6½-inch casing was ripped and 50 sacks of cement was forced through rips. Subsequent tests showed that the company effected a complete shut-off.

The method of correcting formation shut-off failures has already been discussed under the subject of formation shut-off as applied to shut-off for prospecting purposes.

<sup>1</sup>Decisions, Montebello field, Standard Oil Co. Sec. 6, T. 2 S., R. 11 W. Report No. P 1-125, Baldwin No. 5.

<sup>2</sup>Decisions, Coyote Hill field, Sec. 17, T. 3 S., R. 10 W. Standard Oil Co. M/C Well No. 36. Shut-off. T 1-198.

The following illustrates the use of liners for correcting failures. The operations are those of the Southern Pacific Company<sup>1</sup> in the East Side field, Coalinga, Sec. 35, T. 19 S., R. 15 E. In Well No. 46, the cement job on 11-inch casing, at 2550 feet, failed. Cemented 8½-inch liner at 2579 feet with dump bailer. Job failed. In Well No. 76, 10-inch shut-off, cemented at 2524, failed. Ran in 8½-inch liner, 2495 to 2535 feet and cemented with 20 sacks cement, dump bailer. Shut-off satisfactory. In well No. 77 the shut-off with 11-inch casing at 2539 feet failed. Cemented 8½-inch liner at 2552 feet. Shut-off satisfactory.

One other factor at the shoe, namely, nature of water, should be mentioned. For example, if fresh water is identified above the shoe and the water bailed, at test, is sulfur water, it is reasonable to conclude that the sulfur water is coming from some other source than around the shoe.

### Factors Below Shoe.

The possibility of the presence of water, at test, other than that coming from back of the water string was mentioned under Factors at Shoe. In the fore part of this discussion, under the subject of depth of hole, it was stated as a rule, that the hole should be drilled only enough ahead of the shoe to enter formation in place. This distance usually should not be more than five feet. The following are a number of the possible complicating factors which may enter results of test when a hole is drilled into formations differing in character from that in which shut-off was made;

Sand or shale heaving into the bottom of the casing may interfere with test, by preventing movement of water around the shoe into the casing, when shut-off is a failure. If such a plug can not be permanently removed, by tools or by bailing, a string of casing with two or three joints of perforated or screen pipe is run into the hole to hold back heaving formations while making test, or the well is passed for a production test. The one-sided demonstrations gained by production tests have already been mentioned. Report No. T 4-753<sup>2</sup> gives an example of the use of screen pipe for test.

Drilling water is quite frequently absorbed in porous formations where the hole has been drilled for a considerable distance ahead of the shoe. When the well is bailed for test, this water is returned into the hole. The rate of return decreases upon continuous bailing and the water is often completely exhausted during test. Until such a decrease can be positively noted, however, the result of test is not conclusive. Bailing tests at Peshine Well No. 31<sup>3</sup> of the Associated Oil Company in

<sup>1</sup>Decisions, Coalinga field, Sec. 35, T. 19 S., R. 15 E., Southern Pacific Company, Well No. 46, Report No. P 5-244; Well No. 76, Report No. T 5-175; Well No. 77, Report No. T 5-194.

<sup>2</sup>Decisions, Belridge field, Sec. 2, T. 29 S., R. 21 E., General Petroleum Co., Well No. 151, Shut-off, Report T 4-753.

<sup>3</sup>Decisions, Casimata field, Sec. 19, T. 19 N., R. 34 W., Associated Oil Co., Peshine Well No. 31, Shut-off, Report T 3-10.

the Casimolia field give a good example of the presence of drilling water. In Well No. 51<sup>1</sup> of the General Petroleum Company in Belridge field, 15 feet of drilling water and 305 feet of oil entered the hole in 30 hours.

This latter is a case where the well had been drilled into the top of an oil stratum upon drilling out cement. The hydrostatic head of the drilling water forced some of the water into the oil sand and it was returned, upon bailing. In many cases where the hole breaks into an oil stratum, or where high pressure causes the oil confined below a thin crust to "drill itself in," a production test is the only recourse, other than bridging. A high pressure restricted flow of either oil or gas will, undoubtedly, hold water back. An instance<sup>2</sup> has been noted in which a flow of gas from a well, when unrestricted, allowed a flow of 700 barrels of water per day.

When the hole has been drilled ahead into a sand stratum and water appears in considerable quantity at time of test, it is difficult to determine whether the drill has entered a water stratum below the shoe or whether it is simply a case of failure of shut-off. In some instances the whole question of the success or failure in the development of a well, or even in the development of a producing sand over an entire property<sup>3</sup>, hinges upon knowing definitely that the water alleged to be coming from a new sand below the shoe actually originated in that sand and not from around the shoe. The possibilities of a *new* water sand below the shutoff appear to furnish more uncertainties as to the condition and prospective future of a drilling well than any other single feature of operations. Providing that a sand is drilled into while preparing the well for test, it would be a difficult course of reasoning, based upon bailing tests only, which would enable one to differentiate indications and determine the source of water.

If the water is not shut off at the shoe, this new sand, which the operator presently may propose to exclude with another string of casing, may be none other than the oil sand he is looking for.

The complications here involved are illustrated by the following excerpt from transcript of a hearing<sup>4</sup> before the State Oil and Gas Supervisor relative to method of drilling wells in the Sunset Field.

"MR. COLLOM: Mr. Kirwan, I would like to ask you with respect to this question that has come up relative to the possibility of testing a sand immediately below a shoe of casing in which there has not been a shut-off. Do you think that it would be possible in case you did not have a shut-off to definitely determine what is the nature of that sand immediately below that string of casing, that is, as to oil or water?"

<sup>1</sup>Table IV, Belridge field. Sec. 3, T. 29 S., R. 21 E. General Petroleum Co. Well No. 51 Marina. Shut-off. Report T 4-877.

<sup>2</sup>Second Annual Report—Method of Testing Water Shut-off at Oil Wells. Bull. 82, Cal. State Min. Bureau, p. 59.

<sup>3</sup>See graphic logs accompanying Order No. 5—International Well No. 7, Union Oil Company of Cal. Pp. 413 to 450.

<sup>4</sup>Transcript of hearing—Union Oil Company case—regarding wells in Maricopa Flat—Taft, Cal., April 9, 1918.

MR. KIRWAN: A. I believe there are some cases in which if the water above a sand is not shut off that it precludes the possibility of determining whether or not that sand carries oil, providing the water can not be bailed down to a reasonable level which would permit some sort of a test of that sand.

MR. COLLOM: What would be such a condition?

MR. KIRWAN: A. It would depend on the depth of the well, largely. I believe if you bailed the water ordinarily within two or three hundred feet of the bottom and it did not show up any oil, that there would be some probability that there was not an oil sand; however, not conclusive evidence.

MR. COLLOM: We will assume that you have not a shut-off and you bailed the hole and got water, do you think you would be justified in assuming that there was a water-sand?

MR. KIRWAN: A. No, I don't believe you would be justified in assuming it was a water-sand unless you plugged between the shoe and the sand, and then after drilling out the plug if you got water you would assume that it was a water-sand. I don't know any other way by which you could make that test except to plug inside of the water string up say about ten feet and then perforate above the plug, and if you didn't get water you could assume that the water was below the shoe of the water string. I am talking from an experience we have recently had in southern California, in which we demonstrated to the satisfaction of a company that the water which they claimed to be below the shut-off point was above the shut-off point by that method.

MR. COLLOM: What well was that, please?

MR. KIRWAN: A. We had Standard Oil—I believe Murphy Coyote Well No. 31. Another case in southern California was one in which after a shut-off was made above the oil sand, the oil filled up to within 120' or such a matter from the surface. And, in my opinion, this very test goes to show that it is necessary in many cases to have the water shut off before you know the character of the sand below the shut-off point."

In addition to the foregoing, water sands erroneously logged, or oil sands not logged, will interfere with all future engineering study of conditions on a property. This does not mean that the operator should be any the less vigilant in his efforts to detect and correctly log water sands. An inspection of several thousand logs of oil wells drilled in California impresses one with the meagerness of this essential information.

#### **Bridge Below Shoe.**

As applied to this discussion a well is bridged below the shoe for one of two purposes:

- (1) To form a solid seat, in contact with suitable formation, for cementing water string.
- (2) As a plug in the well above oil, water, gas or other porous formations in order to determine if water is excluded at the shoe.

In either case the bridge must be made of impervious material, well bonded with formation, and of sufficient depth to withstand impact of heavy drilling, or heaving pressures from below. Bridges are made of rock, cement, bricks, lead-wool or other material. Bundles of wire line should not be used. They are hard to drill out or sidetrack. The bridge should be at least 20 feet in depth, if thickness of suitable formations will permit. A solid and well bonded bridge will exclude all those sources of complication mentioned in discussion of factors immediately below shoe.

An illustration of a combination of both of these requirements of a bridge, and some of the deficiencies, is given in comments on reports on proposed operations and tests at a well<sup>1</sup> of the Doheny-Pacific Petroleum Company in the Casmalia field.

The hole was bridged at 2450 feet to 2307 feet. Drilled out below 8½-inch casing to test shut-off. Hole filled 2000 feet with water. Another bridge was placed just below shoe of 8½-inch casing in order to test for shut-off. Test not conclusive. Drilled out and made another bridge. Test showed small amount of water. Concluded that if water was coming through or around bridge it would increase in flow upon drilling out. This conclusion was proved to be correct. Water entered at rate of 89 gallons per hour before drilling. Fluid level at 9:00 a.m.—1700 feet. Started drilling at 11:00 a.m. At 12:30 p.m. fluid level was 1235 feet, showing that 465 feet of water had entered the hole during the period of two hours in which the bridge was intact and one and a half hours after drilling started. This represented an average of 370 gallons per hour for the three and a half hours, but the water came in much faster after the drilling was done. The average increase after drilling out bridge was 281 gallons per hour.

### Conclusion.

The foregoing discussion has developed the fact that, when water or oil, or both, move into the well during the period of test for water shut-off, the source of the fluid *must* be determined. The various source factors mentioned change from determinate to indeterminate, or the reverse, according to the extent and efficacy of drilling, bridging, plugging, or other operations conducted during the time the well is subject to test.

Table XVI has been prepared to serve as a guide for indicating the condition of hole necessary to determine, as between success and failure of shut-off, whether the source of fluid is above, at, or below, the shoe.

<sup>1</sup>Decisions, Casmalia field. Lease 2, Doheny-Pacific Petroleum Company. Well No. 1. Reports No. P 3-70, No. P 3-91 and No. T 3-70.

TABLE XVI. Shows Condition of Hole Necessary to Determine Source of Fluid Entering a Well.

Position of factor	Source of water	Condition of shut-off	Plug or bridge in shoe-joint	Hole open just to formation in place	Mechanical condition of hole	Tight bridge just below shoe	Leaky bridge, or no bridge
Above shoe	1. Leaky casing	Success	Determinate, by balling	Determinate, by casing tester.	Determinate, by casing tester.	Determinate, by casing tester.	Excepting presence factors 4 and 5, determine, by casing tester.
		Failure	Determinate, by balling	Indeterminate, except occasionally by casing tester.	Indeterminate, except occasionally by casing tester.	Indeterminate.	
		Success	Determinate, by balling	Determinate, by balling	Determinate, by balling	Indeterminate.	
At shoe	2. Drain-back	Failure	Determinate, by balling	Indeterminate	Indeterminate	Indeterminate	Indeterminate.
		Success	Indeterminate*	No factor	No factor	No factor.	
		Failure	Indeterminate*	Determinate	Determinate	Indeterminate.	
Below shoe	3. Water around shoe (Factor 1, excepted.)	Success	Indeterminate	Determinate	Determinate	Determinate	Determinate.
		Failure	Indeterminate	Indeterminate	Indeterminate	Indeterminate.	
		Success	Indeterminate	Excepting presence of factor 1, determinate.	Excepting presence of factor 1, determinate.	Excepting presence of factor 1, determinate.	
	4. Drilling water (Factors 1 & 5 excepted.)	Failure	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Rarely determinate except when fluid level is higher than that of water excluded.
		Success	Indeterminate	Indeterminate, except by elimination factor 3.*	Indeterminate, except by elimination of factor 3.*	Indeterminate.	
		Failure	Indeterminate	Indeterminate	Indeterminate	Indeterminate.	
Above shoe	Oil and gas	Success	Determinate by perforating opposite oil stratum indicated by log or correlations.	Indeterminate	Indeterminate	Indeterminate	Indeterminate.
		Failure	Determinate by perforating opposite oil stratum indicated by log or correlations.	Indeterminate	Indeterminate	Indeterminate.	
		Success	Indeterminate	Determinate, by balling	Determinate, by balling	Factor 5 excepted, determine. Frequently necessary to ball, swab, or pump.	
Below shoe	Oil and gas	Failure	Indeterminate	Frequently indeterminate	Frequently indeterminate	Frequently indeterminate.	
		Success	Indeterminate	Indeterminate	Indeterminate	Indeterminate.	

\*Success or failure of shut-off is inferentially determinate by perforating or ripping shoe-joint above cement plug.

TABLE I. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		
						Diam. (inches)	Weight (pounds)	Length (feet)
Coyote Hills—								
Sec. 18, T. 3 S., R. 9 W., S. B...	1-24	9 15/17	2,915	-----	Rotary	10	40	2,900
	1-71	12/29/17	2,873	-----	Rotary	10	-----	2,850
Sec. 29, T. 3 S., R. 9 W., S. B...	1-223	5/29/18	2,460	-----	Rotary	10	-----	2,434
Sec. 8, T. 3 S., R. 10 W., S. B...	1-55	11/27/17	5,145	-----	Cable	3	-----	5,135
	1-172	4/18/18	5,475	-----	Cable	2	-----	5,472
Sec. 17, T. 3 S., R. 10 W., S. B...	1-39	10/25/17	3,950	-----	Cable	8 1/2	-----	3,940
	1-65	12/15/17	4,004	-----	Cable	6 1/2	-----	3,990
	1-149	3/21/18	3,629	-----	Cable	8 1/2	36	3,630
	1-17	8/30/17	3,530	-----	Cable	6 1/2	28	3,526
Sec. 18, T. 3 S., R. 10 W., S. B...	1-22	9/ 6/17	3,374	-----	Cable	6 1/2	28	3,368
	1-65	12/13/17	3,625	-----	Cable	8 1/2	36	3,618
	1-49	11/21/17	3,327	-----	Cable	8 1/2	36	3,320
	1-73	1/ 5/18	3,323	-----	Cable	8 1/2	36	3,320
	1-111	2/ 5/18	3,326	-----	Cable	8 1/2	36	3,320
	1-142	3/12/18	3,326	-----	Cable	8 1/2	36	3,320
	1-234	6/11/18	3,320	3,300	Cable	8 1/2	-----	3,300
	1-250	6/25/18	3,307	-----	Cable	8 1/2	-----	3,306
	1-190	5/ 1/18	4,056	Pumping test.	Cable	8 1/2	-----	3,254
	1-81	1/14/18	3,626	-----	Cable	6 1/2	-----	3,620
Sec. 19, T. 3 S., R. 10 W., S. B...	1-5	7/25/17	3,321	-----	Cable	8 1/2	-----	3,315
	1-189	5/ 1/18	4,110	Pumping test.	Cable	8 1/2	-----	3,300
	1-233	6/10/18	4,382	Pumping test.	Cable	8 1/2	-----	3,623
Sec. 20, T. 3 S., R. 10 W., S. B...	1-13	8/15/17	4,354	-----	Cable	6 1/2	26-28	4,347
Sec. 21, T. 3 S., R. 10 W., S. B...	1-32	10/15/17	3,134	-----	Rotary	10	40	3,114
Sec. 22, T. 3 S., R. 10 W., S. B...	1-46	11/ 9/17	3,492	-----	Cable	8 1/2	36	3,480
	1-144	3/16/18	3,634	Pumping test.	Cable	6 1/2	26	3,125
	1-145	3/16/18	3,500	Pumping test.	Rotary	10	40	3,016
	1-27	9/15/17	3,015	-----	Rotary	10	40	3,000
	1-146	3/16/18	3,650	Pumping test.	Rotary	10	40	3,005
Sec. 23, T. 3 S., R. 10 W., S. B...	1-20	9/ 1/17	2,912	-----	Rotary	10	40-45	2,894
	1-154	3/22/18	2,543	-----	Rotary	10	-----	2,523
	1-63	12/11/17	2,416	-----	Rotary	10	40-45	2,406
	1-225	6/ 3/18	2,546	-----	Rotary	10	-----	2,521
	1-107	10/26/17	2,535	Pumping test.	Rotary	10	40-45	2,500
Sec. 24, T. 3 S., R. 11 W., S. B...	1-175	4/22/18	3,723	-----	Rotary	6 1/2	-----	3,723
	1-6	7/25/17	3,610	-----	Rotary	6 1/2	-----	3,600
	1-64	12/12/17	3,740	-----	Cable	6 1/2	29	3,734
	1-229	5/23/18	3,925	Pumping test.	Rotary	8 1/2	-----	3,842
	1-125	2/20/18	4,367	-----	Cable	8 1/2	36	2,460

NUMBER ONE; see page 110.

Number sacks.....	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
	Method			
250	Perkins	-----	Bailed to 2,200'. 7 gals. water from 2,200'.	
250	Tubing	-----	Bailed to 2,000'. 4 gals. water from 2,000'.	
250	Tubing	-----		125' water, 1 hour.
30	Perkins	-----	Bailed to 2,034'. 4 gals. water in 25 hours.	
10	Perkins	-----		3 barrels water, 24 hrs.
90	Perkins	-----		190' water, 23 hours.
20	Perkins	-----		575' water, 18 hours.
70	Perkins	-----		564' water, 22½ hours.
40	Perkins	-----	Hole bailed to 2,507' for test. 6 gals. water from 2,523'.	
40	Perkins	-----	Hole bailed to 2,508' for test. 5 gals. water from 2,508'.	
80	Perkins	-----	Hole bailed to 2,500'. 6' water from 2,500'.	
70	Perkins	-----		229' water, 25 hours.
40	Reement Perkins	-----		388' water, 18 hours.
70	Reement tubing, 100# pressure.	-----		260' water, 23 hours.
40	Reement tubing, 1,200# pressure.	-----		100' water, 21 hours.
70	Perkins	-----		329' water, 55 hours.
30	Reement tubing, 1,275# pressure.	-----		121' water, 55 hours.
70	Perkins	-----	.4% emulsion. No. free water.	
40	Perkins	-----	Bailed to 2,500'. No rise in 23 hours.	
70	Perkins	-----	Bailed to 2,500'. No rise in 18 hours.	
50	Perkins	-----	Averaged less than .4% water.	
100	Perkins	-----	3,924 bbls. per day of oil: no water.	
150	Tubing	-----	Bailed to 2,497'. Rise 9' in 12½ hours.	
250	Tubing	-----	Bailed to 2,397'. No change in fluid level.	
70	Perkins	-----	Bailed to 2,500'. No rise in fluid level.	
100	Tubing	-----	200 bbls. fluid; .4% water.	
300	Tubing	-----	176 bbls. fluid; .3% water.	
250	Tubing	-----	Bailed to 2,400'. No change in fluid level.	
250	Tubing	-----	182 bbls. fluid. 1.5% emulsion.	
300	Perkins	-----	Fluid bailed to 1,800'. No change in fluid level.	
250	Perkins	-----	3' rise in 24½ hours.	
250	Perkins	-----	2' rise in 22½ hours.	
250	Perkins	-----	Sample from 2,519' showed 1% water.	
300	Perkins	-----	116 bbls. fluid; no water.	
200	Tubing	-----		602' water, 24 hours.
15	Reemented through tubing.	-----		Fluid carried water in suspension.
50	Perkins	-----	2½ gals. water in 1½ hours.	
12	Dumped	-----		602 bbls. fluid; 12% water.
70	Perkins	-----		Unable to lower fluid.

TABLE I. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		
						Diam. (inches)	Weight (pounds)	Length (feet)
Newhall—								
Sec. 6, T. 3 S., R. 15 W., S. B...	1-70	12/17/17	500	353	Cable	12 $\frac{1}{2}$	-----	353
	1-1003	5/11/18	913	-----	Cable	10	40	911
Sec. 7, T. 3 S., R. 15 W., S. B...	1-16	8/23/17	474	-----	Cable	8 $\frac{1}{2}$	28	470
Sec. 18, T. 3 S., R. 15 W., S. B...	1-1000	3/ 4/18	600	504	Cable	8 $\frac{1}{2}$	28	517
	1-1002	4/ 4/18	600	501	Cable	8 $\frac{1}{2}$	28	545
Newhall—								
Sec. 16, T. 3 S., R. 16 W., S. B...	1-8	7/31/17	216	-----	Cable	6 $\frac{1}{2}$	20	210
	1-30	10/13/17	146	-----	Cable	6 $\frac{1}{2}$	20	143
	1-35	10/18/17	167	-----	Cable	6 $\frac{1}{2}$	20	167
	1-43	11/ 3/17	232	-----	Cable	4 $\frac{1}{2}$	15	232
Montebello—								
Sec. 31, T. 1 S., R. 11 W., S. B...	1-238	6/17/18	-----	-----	Rotary	12 $\frac{1}{2}$	-----	2,185
	1-204	5/14/18	1,102	-----	Rotary	12 $\frac{1}{2}$	-----	1,100
	1-222	5/29/18	2,316	2,308	Cable	10	-----	2,308
Sec. 6, T. 2 S., R. 11 W., S. B...	1-21	9/ 6/17	1,605	1,580	Rotary	12 $\frac{1}{2}$	45	1,580
	1-210	5/16/18	3,110	Pumping test.	Rotary	12 $\frac{1}{2}$	45	1,960
	1-92	1/23/18	1,207	-----	Rotary	12 $\frac{1}{2}$	45	1,200
	1-119	2/12/18	1,205	-----	Rotary	12 $\frac{1}{2}$	45	1,200
	1-157	3/27/18	1,093	-----	Cable	10	-----	1,688
	1-133	3/ 6/18	1,761	-----	Rotary	12 $\frac{1}{2}$	45	1,755
	1-78	1/ 9/18	1,706	-----	Cable	10	-----	1,701
	1-110	2/ 5/18	1,706	-----	Cable	10	-----	1,701
	1-159	3/29/18	1,706	1,554	Cable	10	-----	1,549
	1-237	6/15/18	1,796	-----	Cable	8 $\frac{1}{2}$	-----	1,776
	1-230	6/ 7/18	1,800	-----	Rotary	12 $\frac{1}{2}$	-----	1,874
	1-36	10/18/17	1,284	-----	Cable	10	45	1,261
	1-169	4/ 9/18	1,820	-----	Rotary	10	-----	1,815
Sec. 6, T. 2 S., R. 11 W., S. B...								
	1-178	4/24/18	2,291	-----	Rotary	10	45	2,286
	1-33	10/16/17	1,696	-----	Cable	8 $\frac{1}{2}$	-----	1,695
	1-97	1/24/18	1,313	-----	Rotary	12 $\frac{1}{2}$	40	1,307
	1-129	3/ 1/18	1,824	-----	Rotary	10	-----	1,820
	1-138	3/ 7/18	2,223	Pumping test.	Rotary	12 $\frac{1}{2}$	40	1,226
	1-181	4/25/18	1,973	1,960	Rotary	12 $\frac{1}{2}$	45	1,960
Sec. 35, T. 1 S., R. 12 W., S. B...								
	1-82	1/17/18	1,673	1,598	Rotary	12 $\frac{1}{2}$	-----	1,598
	1-152	3/22/18	1,464	-----	Cable	12 $\frac{1}{2}$	40	1,441
	1-244	6/22/18	2,486	2,477	Cable	8 $\frac{1}{2}$	-----	2,477
Sec. 1, T. 2 S., R. 12 W., S. B...								
	1-2	7/24/17	2,185	2,125	Rotary	10	45	2,125
	1-3	7/24/17	2,083	2,030	Rotary	12 $\frac{1}{2}$	45	2,030
	1-31	9/24/17	2,110	1,970	Rotary	12 $\frac{1}{2}$	45	1,970
	1-243	6/18/18	2,174	-----	Rotary	12 $\frac{1}{2}$	-----	2,170
	1-79	1/ 9/18	1,930	1,923	Rotary	12 $\frac{1}{2}$	45	1,918

## NUMBER ONE—Continued.

Number sucks	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
Method				
58	Pumped through tubing.			139' water raised in 23 hours.
60	Scott	Drove 23' into blue shale.	12 gals. water in 20 hours. Bailer brought up 3 gals. water off bottom.	
		Driven 8' in blue shale.		243' water, 49 hours.
15	Dump bailer: pressure.		7' muddy water in 25 hours.	
		Driven in brown shale.		11½' water in 20 hours.
		Driven in brown shale.		90' water in 18½ hours.
		Driven in shale.	3' water in 21 hours.	
		Driven 1' 6" in brown shale.	3' water in 27 hours.	
	Perkins		No free water.	
200				92' water in 15 hours
300	Huber & Wilson		10 gals. fluid: 1 qt. oil.	
280	Perkins		20' mud 1-ft in hole. Bailer showed 25' fluid.	
280	Perkins		Pumping test averaged .2% water.	
200	Perkins			332' water in 16 hours.
150	Recemented tubing, 500# pressure.			233' water in 17 hours.
120	Perkins		Bailed to 1,500'. 5 gals. water.	
300	Perkins		8' oil, 1' water in 13½ hours.	
60	Perkins			233' water in 19 hours.
50	Recemented tubing, 500# pressure.			270' water in 15 hours.
60	Perkins		7' water in 13½ hours.	
50	Perkins		Fluid at bottom .4% water.	
200	Perkins			30' water in 7 hours.
		Blue shale		51 gals. water, 25 hrs.
200	Huber & Wilson, 250# pressure.		234' oil and no free water.	
200	Huber & Wilson		No free water.	
50	Perkins		No free water.	
300	Huber & Wilson			181' water in 13½ hrs.
200	Huber & Wilson, 300# pressure.		3 gals. muddy water.	
150	Huber & Wilson			115 bbls. fluid: 150 bbls. water per day.
250	Perkins		Rise of 21' of fluid in 14 hours. 20% water.	
40	Recemented tubing, 600# pressure.			Water came in at rate of 100' per hour.
200	Perkins			422' water in 13 hours.
400	Waggle & Scott		No change in fluid level. Well bailed to 2,015'.	
140	Perkins		Well bailed to 1,500' for test. Showed 5' water at test.	
280	Perkins		Bailed to 1,513' for test, showed 4 gals. water above 1,513'.	
320	Perkins			Oil and water mixed.
300	Perkins		3' oil, 5' water, 17 hours.	
100	Recemented tubing, 900# pressure.			1' oil, ½ water, 23 hrs.

TABLE I. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Tools	Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)		Casing Diam. (inches)	Weight (pounds)	Length (feet)	
Montebello—Continued.									
Sec. 1, T. 2 S., R. 12 W., S. B.	1-58	12/ 6/17	1,990	1,918	Rotary	12½	45	1,918	
	1-105	1/31/18	1,922	1,918	Rotary	12½	45	1,918	
	1-123	2/16/18	1,925	-----	Rotary	12½	45	1,918	
	1-150	3/22/18	1,990	1,970	Cable	10	-----	1,970	
	1-53	11/27/17	2,125	2,105	Rotary	12½	-----	2,105	
	1-93	1/23/18	2,125	2,105	Rotary	12½	-----	2,105	
	1-118	2/12/18	-----	2,105	Rotary	12½	-----	2,105	
	1-167	4/12/18	2,135	2,110	Cable	10½	-----	2,110	
	1-216	5/23/18	2,125	2,115	Cable	10	-----	2,110	
	Sec. 1, T. 2 S., R. 12 W., S. B.	1-136	3/ 7/18	2,227	2,221	Cable	10	-----	2,175
1-165		4/ 8/18	2,195	2,185	Cable	10	-----	2,175	
1-195		5/ 6/18	2,220	-----	Cable	8½	-----	2,215	
1-72		12/31/17	2,070	2,055	Rotary	12½	45	2,055	
1-212		5/17/18	2,193	-----	Cable	10	-----	2,188	
1-205		5/14/18	2,218	2,190	Rotary	12½	-----	2,190	
1-240		6/18/18	2,560	Pumping test.	Rotary	10	40	2,195	
1-196		5/ 8/18	2,340	-----	Cable	8½	-----	2,329	
1-86		1/18/18	2,275	2,247	Rotary	10	-----	2,247	
1-102		1/28/18	2,258	2,246	Rotary	10	-----	2,246	
Sec. 2, T. 2 S., R. 12 W., S. B.	1-241	6/18/18	2,564	Pumping test.	Rotary	10	-----	2,301	
	1-108	2/ 5/18	2,211	2,194	Rotary	10	-----	2,194	
	1-224	5/31/18	2,720	-----	-----	10	-----	2,718	
	1-89	1/19/18	2,465	2,430	Cable	8½	-----	2,430	
	1-75	1/ 5/18	2,067	-----	Rotary	12½	50	2,062	
	1-163	4/ 8/18	2,523	2,514	Cable	10	-----	2,514	
	Whittier—								
	Sec. 15, T. 2 S., R. 11 W., S. B.	1-57	12/ 4/17	821	813	Cable	12½	40	813
	Sec. 22, T. 2 S., R. 11 W., S. B.	1-15	9/22/17	1,336	Casing froze.	Cable	10	40	1,315
	Sec. 25, T. 2 S., R. 11 W., S. B.	1-128	1/14/18	2,642	-----	Cable	6½	-----	2,569
1-252		6/27/18	2,610	-----	Cable	6½	-----	2,599	
1-7		7/30/17	1,144	-----	Cable	12½	45	1,132	
1-251		7/27/18	1,081	-----	Cable	15½	-----	1,075	
1-62		12/11/17	1,458	-----	Cable	12½	45	1,445	
1-131		3/ 2/18	1,854	-----	Cable	12½	45	1,847	
1-246		6/26/18	2,450	-----	Cable	10	40	2,450	
Whittier—									
Sec. 26, T. 2 S., R. 11 W., S. B.	1-1	7/11/17	2,125	-----	Cable	8½	36	2,111	
	1-10	8/23/17	2,440	2,377	Cable	8½	36	2,377	
	1-25	9/15/17	2,175	-----	Cable	10	45	2,162	
	1-14	9/15/17	1,714	1,687	Cable	12½	45	1,687	
	1-56	12/ 1/17	2,306	2,228	Cable	10	-----	2,228	
	1-98	1/24/18	2,264	2,135	Cable	9½	-----	2,135	
	1-151	3/22/18	1,550	1,535	Cable	12½	45	1,534	
	1-173	4/20/18	1,787	-----	Cable	10	-----	1,784	
	1-213	5/18/18	1,818	1,784	Cable	10	-----	1,784	
	1-191	5/ 8/18	1,966	1,966	Cable	12½	-----	1,964	
Sec. 16, T. 1 S., R. 14 W., S. B.	1-217	5/23/18	1,966	1,966	Cable	12½	-----	1,964	
	1-184	4/26/18	1,900	1,870	Cable	12½	45	1,866	
	1-221	5/29/18	1,900	1,870	Cable	12½	45	1,869	
	1-242	6/21/18	1,237	1,248	Cable	8½	-----	1,208	

## NUMBER ONE—Continued.

Number sacks.....	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
	Method			
320	Perkins .....			104' fluid—20% water.
80	Recemented through tubing. ....			31' water in 20 hours.
60	Recemented tubing, 900# pressure. ....			36' water in 17 hours.
80	Perkins .....	2 gals. free water.		
70	Perkins .....			25' water in 26½ hours.
70	Recement through tubing. ....			180' water in 21½ hrs.
70	Recemented tubing, 700# pressure. ....			215' water in 17 hours.
80	Perkins .....			350' water in 15 hours.
120	Recemented tubing, 500# pressure. ....			3 bbls. water per hour.
60	Perkins .....			170' water in 2½ hours.
80	Perkins .....			409' water in 15 hours.
56	Perkins .....	No free water.		
320	Perkins .....	8' water in 10 hours.		
100	Perkins .....	No free water.		
310	Perkins .....	5 gals. water from 2,199'.		
200	Union method .....	500 bbls. per day. .2% water.		
125	Union method .....	Fluid off bottom. 1% water.		
250	Tubing under pres- sure. ....			62' water in 48 hours.
250	Tubing .....	3' water in 14 hours.		
250	Tubing .....	500 bbls. per day. .2% water.		
250	Tubing .....	No free water.		
200	Huber & Wilson .....			Hole full of water.
150	Perkins .....	108' oily mud, 18½ hours.		
150	Huber & Wilson .....	26 gals. water in 25 hours.		
140	Huber & Wilson .....			27½' water in 12 hours.
200	Perkins .....	2' water off bottom.		
		Blue shale. Mud and oil in bailer. No free water.		
30	Recement tubing, 1,300# pressure. ....			Could not bail water down.
65	Perkins .....			360' water in 17 hours.
200	Perkins .....			2' water in 4 hours.
		Blue shale. No fluid entered hole in 26 hours.		
280	Perkins .....	17' oil, mud and water in 34 hrs.		
370	Perkins .....			Casing collapsed at 1,325' while bailing.
		Sticky blue shale. No fluid entered well in 20 hours.		
115	Perkins .....	All oil; no free water.		
200	Perkins .....	All oil; no free water.		
145	Perkins .....	All oil; no free water from bottom.		
300	Perkins .....	19 gals. water in 19½ hours.		
130	Perkins .....	All oil; no free water.		
140	Perkins .....	326' oil, 110' oily mud. No free water in 24 hours.		
320	Perkins .....	3' rise of water in 21½ hours.		
100	Perkins .....			Water level could not be lowered.
50	Recemented tubing, 750# pressure. ....	2 bbls. water in 26 hours.		
100	Perkins .....			10' water in 6 hours.
65	Recemented tubing			26 bbls water in 27 hrs
400	Perkins .....			5 bbls. water in 24 hrs
62	Recemented through tubing. ....			6½ bbls. water in 27½ hours.
75		No free water during test.		

TABLE I. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Tools	Water string		
	Number	Date	Total drilled (feet)	Bridged to (feet)		Casing		
						Diam. (inches)	Weight (pounds)	Length (feet)
Puente—								
T. 2 S., R. 10 W., S. B.....	1 140	3 8/18	2,996	-----	Cable	8 $\frac{1}{2}$	32-36	2,990
Olinda—								
Sec. 8, T. 3 S., R. 9 W., S. B...	1-60	12/ 5/17	1,182	-----	Cable	10	-----	1,171
	1-23	9/ 6/17	1,276	-----	Cable	12 $\frac{1}{2}$	40	1,245
	1-34	10/17/17	1,029	-----	Cable	12 $\frac{1}{2}$	45	988
	1-113	2/ 6/18	994	961	Cable	12 $\frac{1}{2}$	-----	961
	1-209	5/15/18	1,060	-----	Cable	12 $\frac{1}{2}$	-----	1,083
	1-219	5/24/18	1,095	-----	Cable	12 $\frac{1}{2}$	-----	1,086
	1-228	6/ 4/18	854	831	Cable	12 $\frac{1}{2}$	-----	831
	1-218	5/23/18	2,332	2,290	Cable	8 $\frac{1}{2}$	-----	2,290
	1-155	3/22/18	2,295	2,234	Cable	10	-----	2,234
Sec. 8, T. 3 S., R. 9 W., S. B...	1-18	8/30/17	2,805	2,795	Cable	8 $\frac{1}{2}$	32	2,795
	1-120	2/12/18	2,485	-----	Cable	10	40	2,465
Sec. 7, T. 3 S., R. 9 W., S. B...	1-253	6/28/18	3,328	3,280	Cable	8 $\frac{1}{2}$	-----	3,280
Brea Canyon—								
Sec. 2, T. 3 S., R. 9 W., S. B...	1-156	3/26/18	2,312	-----	Cable	10	-----	2,304
	1-200	5/10/18	882	-----	Rotary	15 $\frac{1}{2}$	-----	877
Miscellaneous —								
Sec. 19, T. 1 S., R. 12 W., S. B...	1-164	4/ 8/18	1,545	1,528	Cable	9 $\frac{3}{4}$	-----	1,528
Sec. 25, T. 1 S., R. 13 W., S. B...	1-42	11/ 2/17	1,648	1,636	Cable	10	-----	1,636

## NUMBER ONE—Continued.

Number Sicks.....	Shut-off		Result	
	Cement			
	Method	Formation shut-off	Success	Failure
60	Huber & Wilson.....	-----	15' water in 16½ hours.	
100	Scott .....	-----	40' oil, no water in 5 hours.	
		Shale .....	All oil, no free water brought off bottom.	
		Driven 100' brown shale.	Bailer brought all oil, no free water.	
		-----	1' water in 23 hours.	
100	Scott .....	-----		454' water in 16 hours.
120	Huber & Wilson.....	-----		425' water in 17 hours.
30	Recemented, Huber & Wilson.	-----		
100	Huber & Wilson.....	-----	Mud and oil; no free water.	
100	Perkins .....	-----	No free water in fluid taken from bottom.	
150	Perkins .....	-----	No change in fluid.	
150	Perkins .....	-----	4 gals. water in 22½ hours.	
150	Perkins .....	-----	Rise of 5' fluid in 29½ hours.	
125	Tubing method .....	-----		218' water in 27½ hours.
350	Scott .....	-----	Fluid bailed to 1,500', 5' rise in fluid in 21 hours.	
400	Scott .....	-----	Fluid bailed to 800', 6" rise in fluid in 20 hours.	
100	Perkins .....	-----		Unable to ball fluid below 475'.
150	Perkins .....	-----	Hole filled 9' with water in 24½ hours.	

TABLE II. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing	Length (feet)	
						Diam. (inches)	Weight (pounds)	
<b>Ventura—</b>								
Sec. 21, T. 3 N., R. 23 W., S. B.	2-70	6/29/18	2,146	-----	Cable	10	45	2,146
	2-30	1/11/18	2,006	Pumping test.	Cable	8 $\frac{1}{2}$	32	2,006
<b>Ojai—</b>								
Sec. 17, T. 4 N., R. 21 W., S. B.	2-14	10/12/17	1,010	Pumping test.	Cable	9 $\frac{3}{8}$	28	417
Sec. 12, T. 4 N., R. 21 W., S. B.	2-11	9/11/17	672	-----	Cable	8 $\frac{1}{2}$	28	664
<b>Santa Paula—</b>								
Sec. 22, T. 4 N., R. 21 W., S. B.	2-31	1/17/18	602	-----	Cable	10	40	589
Sec. 18, T. 4 N., R. 20 W., S. B.	2-49	4/ 5/18	940	-----	Cable	9 $\frac{3}{8}$	-----	335
Sec. 20, T. 4 N., R. 20 W., S. B.	2-46	3/11/18	695	-----	Cable	10	40	585
<b>South Mountain—</b>								
Sec. 13, T. 3 S., R. 21 W., S. B.	2-12	9/15/17	2,092	-----	Cable	10	40-45	2,081
	2-7	9/ 5/17	898	887	Cable	12 $\frac{1}{2}$	40	887
	2-63	5/27/18	882	875	Cable	12 $\frac{1}{2}$	40	875
Sec. 18, T. 3 N., R. 20 W., S. B.	2-52	4/26/18	751	-----	Cable	12 $\frac{1}{2}$	-----	738
	2-17	10/25/17	1,487	Pumping test.	Cable	10	40	544
	2-8	9/ 5/17	589	573	Cable	12 $\frac{1}{2}$	40	573
	2-69	6/26/18	738	-----	Cable	12 $\frac{1}{2}$	40	730
	2-53	4/26/18	641	630	Cable	12 $\frac{1}{2}$	40	636
	2-24	12/21/17	589	-----	Cable	10	40	577
Sec. 19, T. 3 N., R. 20 W., S. B.	2-28	1/ 9/18	1,093	-----	Cable	10	40	1,078
Sec. 17, T. 3 N., R. 20 W., S. B.	2-5	8/16/17	810	744	Cable	10	40	744
	2-22	12/17/17	2,030	1,934	Cable	6 $\frac{1}{2}$	-----	1,934
<b>Sespe—</b>								
Sec. 1, T. 4 N., R. 20 W., S. B.	2-56	5/16/18	529	-----	Cable	8	-----	362
Sec. 35, T. 5 N., R. 19 W., S. B.	2-6	8 27, 17	1,051	-----	Cable	9 $\frac{3}{8}$	-----	873
Sec. 23, T. 5 N., R. 20 W., S. B.	2-39	2/11/18	490	-----	Cable	15 $\frac{1}{2}$	70	481
	2-50	4/ 5/18	800	-----	Cable	12 $\frac{1}{2}$	-----	795
<b>Bardsdale--</b>								
Sec. 4, T. 3 N., R. 19 W., S. B.	2-44	3/ 4/18	3,458	3,437	Cable	6 $\frac{1}{2}$	-----	3,435
	2-2	7/18/17	2,792	Pumping test.	Cable	6 $\frac{1}{2}$	-----	2,746
	2-4	7/25/17	763	-----	Cable	12 $\frac{1}{2}$	40	750
	2-9	9/ 5/17	1,246	-----	Cable	10	-----	1,234
	2-10	9/11/17	351	-----	Cable	15 $\frac{1}{2}$	70	332
	2-16	10/20/17	703	-----	Cable	12 $\frac{1}{2}$	40	694
	2-38	2/11/18	1,257	1,150	Cable	12 $\frac{1}{2}$	40	1,150
	2-51	4/26/18	2,065	-----	Cable	10	-----	2,048
	2-19	11/21/17	3,379	-----	Cable	8 $\frac{1}{2}$	36	3,373
Sec. 3, T. 3 N., R. 19 W., S. B.	2-41	2/18/18	967	-----	Cable	12 $\frac{1}{2}$	40	955
	2-33	1/30/18	1,440	1,402	Cable	10	40	1,402

NUMBER TWO; see page 110.

Shut-off		Result	
Cement			
Number shuts.....	Method	Formation shut-off	Success
			Failure
56	Dump bailer.....		Well bailed to 1,000' for test.
23	Pumped through tubing, 800 lbs. pressure.		No rise in fluid in 11½ hrs. 32 bbls. fluid; no water.
		Landed in shale.	6 bbls. oil; no water per day.
		Driven 6' in small hole.	8 gals. water in 38 hours.
		Driven 16'.....	5 gals. oil; no water in 21½ hrs.
		Landed in blue shale.	Bailed at successive depths to 390', no free water.
		Driven 3' in brown shale.	Hole stood dry for 7 days.
200			Water bailed to 1,800' for test.
			No rise in fluid in 16 hours.
40	Dump bailer.....		5 gals. mud in 15 hours.
50	Dump bailer.....		20 gals. mud in 14 hours.
75	Dump bailer and pressure.		1 qt. water in 27½ hours.
		Driven into shale.	22 bbls. oil per day; no water.
50	Dump bailer and air pressure.		3 gals. water in 23 hours.
195	Pumped back of casing.		3 gals. mud and water in 18 hrs.
75	Dump bailer.....		½ gal. fluid, 26 hours.
50	Dump bailer.....		5 gals. water in 14 hours.
20	Dump bailer.....		5 gals. mud, no oil, 12 hours.
17	Dump bailer.....		18' water in 12 hours. Bridge drilled out, 60' open hole.
15	Dump bailer.....		28' water in 19 hours. Water came through bridge.
		Driven into formation.	2 gals. water in 18 hours.
		Driven into formation.	3 gals. water in 7 hours.
20	Dump bailer.....		1 gal. water in 17½ hours.
40	Dump bailer.....		2 gals. water in 21 days.
50	Tubing under pres- sure.		91.4 bbls. water in 7 hrs.
35			46 bbls. fluid, 1.6% water in 24 hours.
20	Dump bailer.....		1' water per hour.
200	Pumped into tub- ing.		No free water.
30	Dump bailer.....		8 gals. mud and water in 21 hrs.
40	Dump bailer.....		2 bailers water in 26 hours.
200	Scott.....		6 gals. water in 16 hours.
100	Dump bailer.....		1 qt. water in 11 hours.
150	Perkins.....		Hole bailed to 2,500'. Brought up 2 gals. water.
		Driven 12' in 10" hole; brown shale.	5 gals. water in 104 hours.
25	Dump bailer.....		10 gals. water in 25½ hours.

TABLE II. DISTRICT

Field, section, township, range, or lease	Time report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		
						Diam. (inches)	Weight (pounds)	Length (feet)
Simi—								
Sec. 36, T. 3 N., R. 18 W., S. B.	2-61	5/24/18	730	714	Cable	10	40	714
	2-65	6/ 5/18	385	-----	Cable	12½	40	316
	2-67	6/15/18	414	-----	Cable	12½	40	403
Sec. 35, T. 3 N., R. 18 W., S. B.	2-20	12/ 5/17	760	700	Cable	8½	28	700
	2-40	2/14/18	1,064	1,045	Cable	8½	28	1,045
	2-26	1/ 2/18	692	646	Cable	10	40	646
	2-37	2/11/18	623	-----	Cable	10	40	613
	2-43	2/25/18	523	-----	Cable	10	40	510
	2-60	5/24/18	695	-----	Cable	10	40	673
Sec. 35, T. 3 N., R. 18 W., S. B.	2-71	6/29/18	859	-----	Cable	10	40	841
Piru—								
Sec. 8, T. 4 N., R. 18 W., S. B.	2-18	11/14/17	866	-----	Cable	6½	20	784
Sec. 36, T. 4 N., R. 18 W., S. B.	2-64	5/27/18	410	-----	Cable	12½	-----	403
Simi—								
Sec. 32, T. 3 N., R. 18 W., S. B.	2-15	10/18/17	1,370	1,205	Cable	12½	40-45	1,205
	2-27	1/ 9/18	1,920	-----	Cable	10	40	1,915

## NUMBER TWO—Continued.

Shut-off		Result	
Cement			
Number Sigsbee	Method	Formation shut-off	Success
50	Dump bailer, driven 6'.	-----	15' fluid in 56 hours.
		Driven 7' in hard shale.	-----
		Driven 6' in 8" hole in shale.	2 gals. muddy water.
40	Dump bailer.	-----	Bailer brought up about 3 gals. free water.
60	Perkins	-----	5 gals. mud in 25½ hours.
60	Perkins	-----	1 gal. mud in 20½ hours.
		Driven 16" 8" hole.	1 gal. muddy water in 35 hours.
		Driven 5' in 8" hole.	Bailer brought up 1 gal. mud, show of oil in 20 hours.
		Driven 7' 6" into shale.	Bailer brought 2 gals. mud, no oil.
		Driven 18" in blue shale.	-----
31	Dump bailer.	-----	2 gals. water off bottom.
40	Scott	-----	Bailer brought up 2 gals. water.
60	Dump bailer.	-----	Bailer came up half full of oil and mud.
100	Perkins	-----	-----
			60 gals. water in 28 hours.
			100' water in 60 hrs.

TABLE III. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing Diam. (inches)	Weight (pounds)	Length (feet)
Arroyo Grande— Sec. 31, T. 31 S., R. 13 E., M. D.	3-77	1/12/18	719	-----	Cable	10	40	713
	3-45	11/ 5/17	608	-----	Cable	8½	28-36	598
	3-80	2/ 5/18	735	-----	Cable	8½	36	730
	3-34	9/24/17	785	745	Cable	10	35-40	745
	3-92	2/ 9/18	760	-----	Cable	10	40	745
Casimalia— Arrellanes Lease -----	3-116	5/14/18	947	-----	Cable	12½	40	940
	3-85	6/24/18	926	-----	Cable	12½	40	920
	3-98	2/20/18	1,453	-----	Cable	10	40-45	1,446
	3-29	9/10/17	862	-----	Cable	12½	40	857
	3-52	11/26/17	842	-----	Cable	12½	40	838
	3-79	1/17/18	1,450	1,330	Cable	10	40	1,330
	3-91	2/ 6/18	1,396	-----	Cable	10	40	1,390
	3-46	11/ 6/18	834	-----	Cable	12½	40	820
	3-61	12/10/17	1,477	-----	Cable	10	40	1,472
	3-1	7/ 2/17	1,379	-----	Cable	10	40	1,375
Soladino Lease -----	3-64	12/27/17	847	-----	Cable	12½	40	840
	3-86	1/28/18	1,421	-----	Cable	10	40-45	1,416
	3-110	4/ 9/18	1,367	-----	Cable	10	40	1,362
	3-25	8/31/17	1,150	1,100	Cable	12½	40	1,100
	3-16	8/16/17	1,595	1,524	Cable	10	40	1,524
	3-27	9/ 4/17	1,549	-----	Cable	10	40	1,545
	3-40	10/15/17	965	-----	Cable	12½	40	963
	3-94	2/ 9/18	1,030	-----	Cable	12½	40	1,030
	3-87	1/28/18	1,123	-----	Cable	10	40	1,119
	3-72	1/ 4/18	352	-----	Cable	12½	40	350
Lease No. 1 -----	3-75	1/ 9/18	919	-----	Cable	12½	40	917
	3-63	12/22/17	976	-----	Cable	12½	40	972
	3-7	7/31/17	1,066	-----	Cable	10	40	1,064
	3-57	12/ 8/17	973	958	Cable	10	40	958
	3-15	8/15/17	1,170	1,141	Cable	12½	40	1,142
	3-58	12/ 8/17	1,125	1,040	Cable	10	40	1,040
	3-6	7/16/17	1,150	1,121	Cable	12½	40	1,116
	3-3	7/19/17	1,167	-----	Cable	12½	40	1,163
	3-69	1/ 2/18	921	-----	Cable	12½	40	919
	3-9	8/ 4/17	1,432	1,407	Cable	10	40	1,407
Lease No. 2 -----	3-50	11/20/17	1,000	-----	Cable	12½	45	993
	3-28	9/ 4/17	1,060	1,030	Cable	12½	40	1,030
	3-30	9/14/17	863	-----	Cable	12½	40	861
	3-37	10/ 3/17	1,242	-----	Cable	12½	40	1,240
	3-19	8/27/17	2,060	1,910	Cable	10	40	1,910
	3-70	1/ 3/18	2,550	2,453	Cable	8½	28	2,453
	3-127	6/17/18	850	-----	Cable	12½	40	856
	3-57	12/ 4/17	1,318	-----	Cable	12½	45	1,341
	3-12	8/ 6/17	730	595	Cable	12½	38-40	576
	3-122	5/31/18	1,647	1,635	Cable	8½	36	1,627
Sec. 3, T. 9 N., R. 35 W., S. B.								

## NUMBER THREE; see page 110.

Number sacks.	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
Method				
38	Tubing		2 gals. mud and water in 24 hrs.	
45	Tubing		2 gals. water in 22 hours.	
45	Tubing		5 gals. water in 45 hours.	
34	Tubing		$\frac{1}{2}$ bailer water and tar in 17 hrs.	
45	Tubing		2 gals. water in 19 hours.	
150	Perkins		6' water in 19 hours.	
150	Perkins			215 gals. water in 12 hours.
150	Perkins		1 gal. water in 26 hours.	
100	Perkins		$\frac{1}{2}$ bailer water in 16 hours.	
100	Perkins		7' water in 12 hours.	
100	Perkins		At end of 14 days pumped 400 bbls. fluid, 1.6% water.	
150	Perkins		5 gals. water in 17 hours.	
100	Perkins		12' water in 19 hours.	
100	Perkins		1 gal. water in 18 hours.	
100	Perkins		Bailer full heavy oil; little water.	
100	Perkins		27 gals. water in 20 hours.	
150	Perkins		1 gal. water in 25 hours.	
100	Perkins		Few gals. muddy water in 24 hrs.	
225	Perkins			Well made $1\frac{1}{2}$ bailers per hour.
125	Perkins		$\frac{3}{4}$ bailer of water in 24 hours.	
120	Perkins		10 gals. water in 24 hours.	
200	Perkins		$\frac{1}{2}$ gal. water in $26\frac{1}{2}$ hours.	
250	Perkins		$\frac{1}{2}$ bailer of water in 16 hours.	
100	Perkins		$\frac{1}{2}$ bailer of water in 15 hours.	
150	Perkins		3 gals. water in 25 hours.	
260	Perkins		5 gals. water in 6 hours.	
200	Perkins		Oil, mud and little water.	
100	Perkins		5 gals. water in 48 hours.	
200	Perkins		At the end of 60 days well produced 450 bbls.; 3.2% water.	
225	Perkins		$\frac{1}{2}$ bailer of water and oil.	
200	Perkins		At end of 30 days produced 400 bbls. fluid; 2.0% water.	
200	Perkins		$\frac{1}{2}$ bailer of water in 36 hours.	
200	Perkins		A few gals. water in 48 hours.	
200	Perkins		18 gals. water in 12 hours.	
325	Perkins			10 gals. water per hr.
200	Perkins		10' of water in 10 days.	
225	Perkins		After successive bailing tests got no free water.	
200	Perkins		$\frac{1}{2}$ bailer water in 24 hours.	
225	Perkins		3 gals. water in 4 days.	
200	Perkins		$\frac{1}{2}$ bailer oil and water in 12 hrs.	
150	Perkins			25 gals. per hour through bridge.
		Temporary shut-off.	Hole stood dry for 15 hours.	
200	Perkins		7' water in $23\frac{1}{2}$ hours.	
40	Dump bailer		5 gals. water in 40 hours.	
22	Dump bailer			138 gals. water in 25 hours.

TABLE III. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		
						Di- am. (inches)	Weight (pounds)	Length (feet)
Casmalia—Continued.								
Morganti Lease -----	3-114	4/27/18	965	-----	Cable	12½	40	960
	3-132	6/24/18	1,480	-----	Cable	10	40-45	1,472
	3-68	1/ 1/18	1,155	-----	Cable	12½	40	1,150
	3-102	3/11/18	1,687	-----	Cable	10	40-45	1,680
	3-44	10/30/17	1,105	-----	Cable	12½	40	1,100
	3-62	12/10/17	1,643	-----	Cable	10	40	1,638
	3-38	10/10/17	1,105	-----	Cable	12½	40	1,100
	3-54	11/30/17	1,040	-----	Cable	12½	40	1,035
	3-54	11/30/17	1,040	-----	Cable	12½	40	1,035
Peshine Lease -----	3-18	8/24/17	1,177	-----	Cable	12½	40	1,172
	3-55	11/30/17	1,188	-----	Cable	12½	40	1,180
	3-120	5/20/18	1,397	-----	Cable	10	40-45	1,390
	3-129	6/21/18	540	-----	Cable	12½	40	534
	3-119	5/20/18	1,426	-----	Cable	12½	40	1,421
	3-119	5/20/18	-----	-----	Cable	15½	-----	455
	3-117	5/14/18	1,324	-----	Cable	12½	40	128
	3-125	6/12/18	1,329	-----	Cable	10	40-45	1,324
	3-10	8/ 4/17	1,035	-----	Cable	12½	40	1,030
	3-2	7/ 2/17	1,160	1,136	Cable	12½	40	1,136
Escolle Lease -----	3-56	12/ 1/17	1,181	-----	Cable	12½	40	1,178
	3-101	2/26/18	1,470	-----	Rotary	10	40	1,465
	3-26	9/ 3/17	1,510	-----	Cable	12½	40	1,488
	3-95	2/11/18	1,430	-----	Rotary	10	40	1,423
	3-100	2/27/18	1,453	-----	Rotary	10	40	1,440
	3-123	6/ 1/18	1,316	-----	Rotary	10	36-40	1,310
Newhall Lease -----	3-32	9/17/17	595	-----	Cable	15½	70	593
	3-49	11/19/17	1,618	-----	Cable	12½	45	1,601
	3-97	2/18/18	2,797	-----	Cable	10	45	2,795
Santa Maria—								
Graciosa Lease -----	3-66	12-28-17	3,310	Pumping test.	Cable	8¼	36	3,304
	3-20	8-29/17	4,065	Pumping test.	Cable	4½	-----	3,632
	3-21	8/29/17	3,306	Pumping test.	Cable	6¼	-----	3,286
	3-96	2/18/18	3,574	Pumping test.	Cable	6¼	-----	3,554
	3-22	8/31/17	416	-----	Cable	12½	40	396
	3-90	2/ 4/18	3,468	-----	Cable	8¼	36	3,456
Carreaga Lease -----	3-36	10/ 1/17	461	-----	Cable	12½	40	453
	3-74	1- 5/18	2,400	-----	Cable	10	40	2,392
	3-112	4-25/18	405	-----	Cable	12½	40	401
	3-118	5/18/18	396	-----	Cable	12½	40	390
	3-128	6/19/18	582	-----	Cable	12½	40	577

## NUMBER THREE—Continued.

Number sacks	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
Method				
150 Perkins				35 gals. water in 3 hrs.
200 Perkins			10 gals. water in 12 hours.	
100 Perkins			72 gals. water in 20 hours.	
150 Perkins			6' water in 12 hours.	
100 Perkins			5 gals. water in 15½ hours.	
100 Perkins			50 gals. drilling water in 12 hrs.	
100 Perkins			3' water in 13 hours.	
100 Perkins				Company reported no job.
50 Recemented Perkins.				11½ bailers water in 20 hours.
147 Perkins			Hole stood dry 15 hours.	
150 Perkins			5 gals. water in 9 hours.	
150 Perkins			Drilling water returned; 36 gals. water in 12 hours.	
150 Perkins			5 gals. water in 15 hours.	
150 Perkins			Water bailed to 1,187'; no increase in fluid level.	
Perkins				Company stated job a failure.
		Driven 20' in blue shale.	Temporary shut-off for prospecting; hole dry 23 hours.	
150 Perkins			Hole stood dry 12 hours.	
200 Perkins			After drilling ahead 50', well stood dry 10 hours.	
100 Perkins			½ bailer mud, water and oil in 25 hours.	
300 Perkins			3 gals. water in 20 hours.	
250 Perkins			¾ bailer water in 22½ hours.	
200 Tubing			¾ bailer oil and water in 24 hrs.	
250 Perkins			4 gals. water and oil in 12 hrs.	
250 Perkins			10 gals. water and oil in 16 hrs.	
200 Perkins			Hole stood dry 12½ hours.	
56 Dump bailer			1 qt. water in 22 hours.	
56 Dump bailer			Hole bailed to 800'; raised 3' water in 33 hours.	
42 Dump bailer			Hole bailed to 2,000'; raised 4' in 33 hours.	
250 Perkins			Well pumped 25 bbls. fluid, .8% water.	
Tubing			Fluid pumped 3.8% water.	
Tubing				26% water after pumping 10 days
250 Perkins			½ bbl. water at end of 4 days.	
		Landed in blue clay.	1 gal. water in 17 hours.	
250 Perkins			Fluid bailed to 2,802'. No change in level.	
		Landed in blue shale.	Bailed dry. No water after 16 hours.	
100 Perkins			Water bailed to 1,807'. ½ bailer water from 1,807'.	
		Landed in blue shale.	1 gal. mud after 12½ hours.	
		Landed in blue shale.	5 gals. mud after 12 hours.	
		Landed in blue shale.	2 gals. mud after 16 hours.	

TABLE III. DISTRICT

Field, section, township, range, or lease	Report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		
						Diam. (inches)	Weight (pounds)	Length (feet)
Santa Maria—Continued.								
Newlove Lease -----	3-23	9/ 6/17	3,740	3,717	Cable	6½	-----	3,717
	3-43	10/27/17	3,312	-----	Cable	6½	-----	3,298
Sec. 26, T. 9 N., R. 34 W., S. B.	3-65	12/28/17	3,295	Pumping test.	Cable	6½	26	3,235
	3-4	7/11/17	3,584	-----	Cable	6½	26	3,584
Cat Canyon—								
Sec. 30, T. 9 N., R. 32 W., S. B.	3-31	9/15/17	2,100	-----	Rotary	10	26	2,095
	3-73	1/ 5/18	2,120	-----	Rotary	10	40	2,115
Sec. 31, T. 9 N., R. 32 W., S. B.	3-105	3/15/18	2,196	-----	Rotary	10	40	2,190
	3-47	11/ 8/17	1,657	-----	Cable	8½	23	1,652
	3-81	1/18/18	2,027	-----	Cable	6½	26	2,025
Sec. 23, T. 9 N., R. 33 W., S. B.	3-113	4/25/18	2,524	-----	Cable	6½	-----	2,512
	3-17	8/16/17	2,872	-----	Cable	8½	23	2,870
Sec. 26, T. 9 N., R. 33 W., S. B.	3-78	1/14/18	1,191	-----	Rotary	12½	40	1,184
	3-106	3/30/18	2,700	-----	Rotary	8½	36	2,696
	3-35	9/29/17	2,855	-----	Rotary	8½	36	2,851
Bell Lease -----	3-41	10/25/17	3,075	3,063	Cable	8½	32	3,066
	3-13	8/15/17	3,147	3,087	Cable	8½	32	3,119
	3-11	8/ 4/17	2,795	2,750	Cable	8½	48	2,736
	3-24	9/ 5/17	3,010	-----	Rotary	11	60	3,004
	3-53	11/27/17	3,515	3,490	Cable	8½	32	3,490
	3-121	5/23/18	3,960	3,954	Cable	8½	32	3,954
	3-107	4/ 3/18	3,668	3,601	Cable	6½	26	3,601
	3-14	8/15/17	2,619	2,614	Rotary	10	40	2,614
	3-39	10/12/17	2,592	2,576	Rotary	10	40	2,576
Los Alamos -----	3-5	7/12/17	3,465	3,438	Cable	8½	36	3,438
	3-33	9/21/17	3,356	-----	Cable	8½	36	3,351
	3-76	1/11/18	493	-----	Rotary	15½	70	450
	3-88	1/30/18	2,627	-----	Rotary	10	45	2,622

## NUMBER THREE—Continued.

Number sacks	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
	Method			
250	Pumped through casing.	-----	120 bbls. of fluid; 5% water at end of 12 days.	
250	Pumped through casing.	-----	Bailer brought oil off bottom; very little water.	
250	Perkins	-----	200 bbls. fluid; .6% water.	
250	Tubing	-----	Water bailed to 2,856'; no change in fluid level.	
200	Perkins	-----	Water bailed to 1,540'; no change in fluid level in 13 hours.	
250	Perkins	-----	3 gals. water in 22½ hours.	
550	Perkins	-----	Water bailed to 1,230'; no change in fluid in 17 hours.	
150	Pumped into casing	-----		73' water in 28 hrs.
221	Perkins	-----	6 gals. water in 12 hours.	
120	Perkins	-----	Water bailed to 1,700'; no change in fluid level in 18 hours.	
120	Perkins	-----	Hole bailed to 2,100'; no change in fluid level in 18 hours.	
200	Perkins	-----	Bailed to 887'; no change in fluid level.	
221	Perkins	-----	Hole bailed to 1,523'; no change in fluid in 17 hours.	
250	Tubing	-----	1 qt. of water in 17 hours.	
100	Tubing	-----	3' water in 12 hours.	
120	Tubing	-----	5 gals. water in 12 hours.	
100	Tubing	-----	1 bailer of water in 24 hours.	
100	Tubing	-----	2 gals. water in 13 hours.	
60	Tubing	-----		300' water in 24 hrs.
150	Tubing	-----	5 gals. water in 27 hours.	
150	Tubing	-----	10 gals. oily mud in 18 hours.	
250	Tubing	-----	A few gals. water in 18 hours.	
250	Tubing	-----	No water in 22½ hours.	
65	Perkins	-----	Bailed to 2,370'; no change in fluid level.	
80	Perkins	-----	Bailed to 2,400'; no change in fluid in 26 hours.	
70	Perkins	-----	Hole stood dry 2 days.	
200	Perkins	-----	Hole bailed to 2,100'; no change in fluid.	

TABLE IV. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		Length (feet)
						Diam. (inches)	Weight (pounds)	
Lost Hills—								
Sec. 3, T. 26 S., R. 20 E., M. D.	4-534	7/ 9/17	665	-----	Cable	12½	40	657
	4-599	8/14/17	1,210	-----	Cable	10	-----	1,201
	4-1014	2/18/18	2,555	-----	Cable	8½	-----	2,540
Sec. 11, T. 26 S., R. 20 E., M. D.	4-540	7/19/17	964	-----	Cable	10	-----	964
	4-838	12/ 5/17	736	709	Cable	10	-----	709
Sec. 19, T. 26 S., R. 21 E., M. D.	4-1032	2/21/18	522	-----	Cable	10	-----	520
	4-1238	5/ 7/18	385	-----	Cable	10	-----	367
	4-1277	5/22/18	495	-----	Cable	10	-----	437
4-1352	6/ 18/18	725	-----	Cable	8½	-----	709	
	4-1353	6/18/18	804	-----	Cable	8½	-----	800
	4-638	9/17/17	672	-----	Cable	10	40	665
Sec. 29, T. 26 S., R. 21 E., M. D.	4-848	12/ 9/17	715	704	Cable	10	40	698
	4-634	8/27/17	690	-----	Cable	8½	-----	681
	4-921	1/11/18	680	-----	Cable	10	40	672
Bridge—								
Sec. 26, T. 27 S., R. 20 E., M. D.	4-672	9/17/17	4,136	-----	Cable	6½	-----	4,131
	4-750	10/23/17	4,321	-----	Cable	4½	-----	4,316
	4-571	8/ 2/17	1,951	-----	Cable	12½	-----	1,947
Sec. 35, T. 27 S., R. 20 E., M. D.	4-1108	3/21/18	4,255	-----	Cable	6½	-----	4,248
	4-710	10/ 4/17	3,982	-----	Cable	8½	-----	3,964
Sec. 36, T. 27 S., R. 20 E., M. D.	4-503	7/ 7/17	4,189	-----	Cable	6½	28	4,183
	4-1073	3/ 6/18	710	Pumping test.	Cable	10	35	525
	4-1169	4/10/18	570	-----	Cable	10	35	560
4-1160	4-10-18	540	-----	Cable	10	35	540	
	4-1269	5/21/18	691	-----	Cable	8½	28	684
	4-1070	3/ 6/18	710	-----	Cable	10	35	608
Sec. 36, T. 27 S., R. 20 E., M. D.	4-1225	5/ 1/18	720	-----	Cable	8½	28	705
	4-1225	5/ 1/18	702	678	Cable	10	35	678
	4-1109	3/21/18	665	-----	Cable	10	35	661
Sec. 5, T. 27 S., R. 21 E., M. D.	4-996	2/ 7/18	1,515	-----	Cable	8½	-----	1,510
	4-800	11/23/17	1,314	-----	Cable	8½	-----	1,308
Sec. 28, T. 28 S., R. 21 E., M. D.	4-1236	5/ 7/18	685	Pumping test.	Cable	8½	28	685
	4-729	10/13/17	2,660	Pumping test.	Cable	8½	28	2,578
	4-677	9/21/17	2,629	-----	Cable	8½	28	2,624
4-768	10/31/17	3,061	-----	Cable	6½	-----	3,061	
	4-1056	3/ 3/18	3,302	-----	Cable	4½	-----	3,296
	4-654	9/10/17	749	-----	Cable	12½	-----	746
4-1291	5/24/18	4,003	-----	Cable	6½	-----	3,993	
	4-968	1/ 8/18	814	-----	Cable	12½	-----	810
	4-1146	4/ 2/18	1,250	859	Cable	10	-----	851
4-1146	4/ 2/18	1,250	-----	Cable	10	-----	851	
	4-1146	4/ 2/18	1,250	859	Cable	10	-----	851
	4-1222	5/ 1/18	1,250	869	Cable	10	-----	856
	4-1329	6/ 7/18	1,225	868	Cable	8½	-----	896

NUMBER FOUR; see page 110.

Number sacks.	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
Method				
97			8' of water in 18 hours.	
100	Perkins		1 gal. water in 21 hours.	
175			Hole bailed to 1,700'. Rise of 15' in fluid in 21 hours.	
90			No water in 24 hours.	
7	Dump bailer		10' of water in 23 hours.	
5	Dump bailer		5' of water in 30½ hours.	
		Landed on shell.	3' of water in 21 hours.	
		Landed in blue shale.		43' thin mud in 23 hrs.
		Landed in shale.	Prospect shut off. 5' of water in 13½ hours.	
		Landed in shale.	Prospect shut off. 3' of water in 21 hours.	
100	Tubing		10' water in 17 hours, due to drain back.	
100	Tubing		10' of oil and water in 19 hours.	
50	Tubing		227' oil; no water in 18½ hours.	
100	Tubing		70' oil; no water in 23 hours.	
120	Casing		Hole bailed dry. 5' rise in water.	
50	Casing		20' water in 16 hours.	
100	Dump bailer		5' water in 16½ hours.	
76	Casing		20' oil; no water in 19½ hours.	
120	Casing; Scott		1 gals. water in 29 hours.	
100			30' water in 30 hours.	
22	Dump bailer			At end of 60 days 27.2% water.
75	Tubing		5' water in 24 hours.	
40	Tubing			Company reported could not bail down.
50	Tubing		10' water in 16 hours.	Making considerable water.
20	Dump bailer			
50	Pumped through tubing.		3' water in 13 hours.	
40	Pumped through tubing.			Company reported no job.
70	Pumped through tubing.		20' tar sand, no water in 3 hours.	
50	Perkins		Bailed to 1,200'. 4' rise in 12½ hours.	
60	Baker		No water in 23 hours.	
100	Scott		2.0% water at end of 7 days.	
?	?		No water at end of 66 days.	
24	Dump bailer		Hole bailed to 1,809'. Fluid dropped 200'.	
75				6 bbls. in 24 hours.
28	Pumped through casing.		Hole bailed to 1,850'. No change in fluid level.	
		4 jts. driven into 11½" hole.	No water in 28 hours.	
125	Pumped		Hole bailed to 2,250'. Rise of 10' in 18 hours.	
40	Dump bailer		6' of water in 21 hours.	
42	Dump bailer			Company reported no job.
42	Reeemented dump bailer.			Company reported no job.
50	Dumped into casing			10' water in 21 hours.
90	Perkins			120' rise in 6½ hours.
100	Perkins		4' of water in 22 hours.	

TABLE IV. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Tools	Water string		
	Number	Date	Total drilled (feet)	Bridged to (feet)		Casing Diam. (inches)	Weight (pounds)	Length (feet)
Belridge—Continued.								
Sec. 2, T. 29 S., R. 21 E., M. D.	4-606	8/17/17	566	-----	Rotary	12 $\frac{1}{2}$	45	561
	4-525	7/17/17	575	-----	Rotary	12 $\frac{1}{2}$	-----	570
	4-519	7/11/17	558	-----	Rotary	12 $\frac{1}{2}$	-----	551
	4-658	9/12/17	591	-----	Rotary	12 $\frac{1}{2}$	-----	589
	4-605	8/17/17	570	-----	Rotary	12 $\frac{1}{2}$	40	569
	4-1196	4/23/18	572	-----	Rotary	12 $\frac{1}{2}$	40	569
	4-1266	5/21/18	588	-----	Cable	10	40	586
	4-1328	6/ 8/18	646	-----	Cable	8 $\frac{1}{2}$	-----	645
	4-1072	3/ 6/18	566	-----	Rotary	12 $\frac{1}{2}$	40	564
	4-1169	4/13/18	608	-----	Cable	10	40	606
	4-1215	4/26/18	670	-----	Cable	8 $\frac{1}{2}$	-----	667
	4-1298	5/25/18	818	674	Cable	10	40	670
	4-704	10/ 1/17	575	-----	Rotary	12 $\frac{1}{2}$	40	574
	4-721	10/ 9/17	637	-----	Rotary	10	-----	655
	4-803	11/23/17	581	-----	Rotary	12 $\frac{1}{2}$	40	580
	4-761	10/29/17	583	-----	Rotary	12 $\frac{1}{2}$	40	576
	4-722	10/ 9/17	589	-----	Rotary	12 $\frac{1}{2}$	40	587
	4-777	11/ 5/17	603	-----	Rotary	12 $\frac{1}{2}$	40	599
	4-889	12/30/17	607	-----	Rotary	12 $\frac{1}{2}$	40	603
	4-865	12/15/17	607	-----	Rotary	12 $\frac{1}{2}$	40	604
	4-843	12/ 7/17	590	-----	Rotary	12 $\frac{1}{2}$	40	588
	4-1369	6/21/18	583	-----	Rotary	12 $\frac{1}{2}$	40	580
	4-1294	5/24/18	587	-----	Rotary	12 $\frac{1}{2}$	40	584
	4-1375	6/28/18	595	-----	Rotary	10	40	590
	4-1114	3/23/18	620	-----	Rotary	12 $\frac{1}{2}$	40	615
	4-906	1/ 8/18	605	-----	Rotary	12 $\frac{1}{2}$	40	603
	4-967	1/27/18	610	-----	Rotary	12 $\frac{1}{2}$	40	607
	4-1006	2/ 9/18	655	-----	Cable	10	40	653
4-1100	3/17/18	775	-----	Cable	10	40	761	
4-1131	3/29/18	640	-----	Rotary	12 $\frac{1}{2}$	40	640	
4-1249	5/10/18	599	-----	Rotary	12 $\frac{1}{2}$	40	597	
4-1339	6/11/18	622	-----	Rotary	12 $\frac{1}{2}$	40	618	
4-1058	3/ 3/18	545	-----	Cable	12 $\frac{1}{2}$	40	540	
4-1177	4/17/18	584	-----	Cable	10	40	582	
4-1325	6/ 4/18	930	586	Cable	10	40	586	
4-944	1/18/18	626	-----	Rotary	12 $\frac{1}{2}$	40	624	
4-991	2/ 4/18	638	-----	Rotary	12 $\frac{1}{2}$	40	635	
4-577	8/ 3/17	548	-----	Rotary	12 $\frac{1}{2}$	40	584	
4-577	8/ 3/17	990	577	Rotary	10	40	577	
4-799	11/23/17	629	-----	Rotary	12 $\frac{1}{2}$	40	626	
4-1103	3/18/18	651	-----	Rotary	12 $\frac{1}{2}$	40	647	
4-1258	5/20/18	982	793	Cable	10	40	793	
4-806	11/25/17	629	-----	Rotary	12 $\frac{1}{2}$	40	624	
4-617	8/21/17	625	-----	Rotary	12 $\frac{1}{2}$	40	622	
4-1153	4/ 6/18	1,022	643	Rotary	12 $\frac{1}{2}$	40	633	
4-862	12/13/17	649	-----	Rotary	12 $\frac{1}{2}$	40	645	
4-1022	2/20/18	790	-----	Cable	10	40	781	
4-770	10/31/17	643	-----	Rotary	12 $\frac{1}{2}$	40	640	
4-797	11/23/17	780	-----	Cable	10	40	778	
4-877	12/21/17	736	617	Rotary	12 $\frac{1}{2}$	40	697	
4-505	7/ 7/17	727	-----	Rotary	12 $\frac{1}{2}$	40	725	
Sec. 8, T. 29 S., R. 21 E., M. D.	1-717	10/ 6/17	3,170	-----	Cable	10	-----	3,150

## NUMBER FOUR—Continued.

Number sacks.	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
Method				
100 Perkins	-----	-----	3' of water in 16½ hours.	
100 Perkins	-----	-----	15' of oil and water in 38 hours.	
100 Perkins	-----	-----	7' of water in 13 hours.	
100 Perkins	-----	-----	10' of water in 20½ hours.	
100 Perkins	-----	-----	1' of water in 24 hours.	
100 Perkins	-----	-----	-----	10' of water in 2 hrs.
5 Dump bailer	-----	-----	Prospect shut off. 2' of water in 17 hours.	
6 Driven 2'; dump bailer.	-----	-----	Prospect shut off. 1' of water in 12 hours.	
100 Perkins	-----	-----	-----	Tested with string of 10" 2 joints screen pipe. 129' of water in 15 hours.
12 Driven into small hole. Dump bailer.	-----	-----	1' of water in 21 hours.	
6 Dump bailer	-----	-----	10' of water in 19 hours.	
24 Perkins	-----	-----	1' of water in 18½ hours.	
100 Perkins	-----	-----	-----	Could not bail dry.
10 Dump bailer. Drain into 8" hole.	-----	-----	-----	
160 Perkins	-----	-----	1' of water in 15 hours.	
160 Perkins	-----	-----	12' oil and water in 20½ hours.	
160 Perkins	-----	-----	2' of water in 15½ hours.	
160 Perkins	-----	-----	No water in 23 hours.	
160 Perkins	-----	-----	No water in 46 hours.	
160 Perkins	-----	-----	2' of water in 21 hours.	
160 Perkins	-----	-----	No water in 18 hours.	
160 Perkins	-----	-----	4' of water in 13 hours.	
160 Perkins	-----	-----	-----	95' of water in 7 hrs.
6 Dump bailer	-----	-----	6' of water in 19 hours.	
160 Perkins	-----	-----	5 gals. water in 12 hours.	
160 Perkins	-----	-----	2' of water in 27 hours.	
160 Perkins	-----	-----	1' of water in 24½ hours.	
6 Dump bailer	-----	-----	Prospect shut off. 1' of water in 14½ hours.	
40 Perkins	-----	-----	10 gals. of water in 16 hours.	
100 Perkins	-----	-----	2' of water in 15 hours.	
160 Perkins	-----	-----	5' of water in 12 hours.	
100 Perkins	-----	-----	2' of water in 12 hours.	
70 Perkins	-----	-----	9' of water in 25½ hours.	
12 Dump bailer	-----	-----	5' of water in 18½ hours.	
12 Dump bailer	-----	-----	-----	114' of water in 18 hrs.
100 Perkins	-----	-----	No water in 18 hours.	
100 Perkins	-----	-----	1' of water in 18 hours.	
160 Perkins	-----	-----	-----	Company reported shut-off failure.
14 Dump bailer	-----	-----	Pumping test. 4 bbls. water per day.	
100 Perkins	-----	-----	No water in 16 hours.	
100 Perkins	-----	-----	No water in 13 hours.	
50 Perkins	-----	-----	2' of water in 19 hours.	
160 Perkins	-----	-----	20 gals. water in 19 hours.	
160 Perkins	-----	-----	2½' of water in 16 hours.	
160 Perkins	-----	-----	-----	48' of water in 19 hrs.
160 Perkins	-----	-----	5' of water in 15½ hours.	
20 Dump bailer	-----	-----	-----	180' water in 100 hrs.
100 Perkins	-----	-----	1' of water in 13 hours.	
75 Dump bailer	-----	-----	No water in 22½ hours.	
100 Perkins	-----	-----	15' drilling water in 30 hours.	
100 Perkins	-----	-----	2' water in 22½ hours.	
100 Perkins	-----	-----	Hole bailed to 1,800'. 10' rise in 18 hours.	



## NUMBER FOUR—Continued.

Number wells.	Shut-off		Result	
	Cement		Success	Failure
	Method	Formation shut-off		
7	Dump bailer		2' of water in 15 hours.	
160	Perkins			Company reported water not shut off. 10' of sand in casing from behind 8 $\frac{1}{2}$ . 100 bbls. water per day. 258' water in 18 hrs.
15	Dump bailer		10' of water in 21 hours.	
5	Dump bailer			
130	Scott		4' of water in 17 hours.	
20	Scott			
35	Scott		20' oil; no water in 23 hours.	
20	Dump bailer			
60	Perkins		2' water; 160' oil; in 19 hours.	
60	Huber & Wilson		1 bbl. water in 12 hours.	
100	Tubing		3' of water in 23 hours.	
80	Tubing		No water in 27 hours.	
		Landed in blue clay.	3' of mud in 73 hours.	
		Landed in blue clay.	1' of water in 43 hours.	
		Driven 5'; brown clay.	No water in 31 hours.	
		Landed in brown clay.	2' of mud in 31 $\frac{1}{2}$ hours	
		Landed in blue clay.		90' of water in 22 hrs
100	Tubing		2' of water in 15 $\frac{1}{2}$ hours	
100	Tubing		10 gals. water in 17 hours.	
200	Perkins		1' of water in 20 hours.	
60	Perkins		45' oil; no water in 23 $\frac{1}{2}$ hours.	
25	Dump bailer		Trace of water at end of 130 days.	
		Landed in blue clay.	No water in 46 hours.	
50	Huber & Wilson		No water in 45 hours.	
160	Perkins		Hole bailed to 1,916'. No rise of fluid in 49 $\frac{1}{2}$ hours.	
160	Perkins		Hole bailed to 2,053'. No rise in water in 48 hours.	
80	Perkins		Hole bailed to 2,510'. No rise in water in 24 hours.	
160	Perkins		2' of mud in 27 hours.	
100	Perkins		2' of oil; no water in 10 hours.	
50	Perkins		4' of water in 22 hours.	
25	Dump bailer		3' of water in 20 $\frac{1}{2}$ hours.	
		Landed in brown shale.	10' of water in 27 $\frac{1}{2}$ hours.	
75	Pumped into casing		4' water in 31 hours.	
28	Dump bailer		25 bbls. fluid; 8% emulsion at end of 30 days.	
25	Dump bailer		50 bbls. fluid; .8% water at end of 73 days.	
25	Dump bailer		110' of oil; no water in 18 $\frac{1}{2}$ hours.	
30	Dump bailer		10' of oil; no water in 19 $\frac{1}{2}$ hours.	
8	Scott		75 bbls. of fluid; no water at end of 18 days.	
		Landed in blue clay.	12' oil; no water in 22 $\frac{1}{2}$ hours.	
		Driven into blue shale.	No water in 31 hours.	
		Landed in blue clay.	45 bbls. fluid; no water, at end of 23 days.	
		Landed in blue clay.	30 bbls. fluid; .2% water, at end of 76 days.	
50			2' of water in 23 $\frac{1}{2}$ hours.	
80	Scott		5' of water in 44 hours.	

TABLE IV. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing Diam. (inches)	Weight (pounds)	Length (feet)
Midway -Continued.								
Sec. 21, T. 31 S., R. 22 E., M. D.	4-529	7/14/17	1,419	-----	Cable	10	-----	1,414
	4-737	10/15/17	1,780	1,730	Cable	8 $\frac{1}{2}$	-----	1,722
	4-1223	5/ 1/18	3,063	2,804	Cable	4 $\frac{1}{2}$	-----	2,804
Sec. 26, T. 31 S., R. 22 E., M. D.	4-801	11/23/17	1,008	-----	Cable	12 $\frac{1}{2}$	40	1,004
	4-930	1/16/18	1,658	-----	Cable	10	40	1,652
	4-732	10/15/17	1,730	-----	Cable	10	40	1,725
	4-902	1/ 3/18	1,059	-----	Cable	12 $\frac{1}{2}$	40	1,051
	4-1005	2/ 9/18	1,700	-----	Cable	10	40	1,695
	4-1110	3/21/18	933	-----	Cable	12 $\frac{1}{2}$	40	928
	4-1205	4/24/18	1,638	-----	Cable	10	40	1,630
	4-1272	5/21/18	1,018	-----	Cable	12 $\frac{1}{2}$	40	1,015
	4-1346	6/14/18	1,500	-----	Cable	10	40	1,480
	4-795	11/23/17	1,057	-----	Rotary	8 $\frac{1}{2}$	28	1,047
	4-1157	4/ 6/18	1,136	-----	Rotary	8 $\frac{1}{2}$	28	1,176
	4-1221	5/ 1/18	1,125	-----	Rotary	8 $\frac{1}{2}$	28	1,107
	4-830	12/ 3/17	1,012	-----	Cable	10	40	1,010
	4-720	10/ 8/17	971	-----	Cable	10	40	958
	4-841	12/ 6/17	892	-----	Cable	12 $\frac{1}{2}$	40	886
	4-919	1/11/18	1,516	-----	Cable	10	40	1,507
	4-1142	4/ 1/18	900	-----	Cable	12 $\frac{1}{2}$	40	894
	4-1207	4/23/18	1,550	-----	Cable	10	40	1,543
	4-510	7/ 7/17	1,600	-----	Rotary	10	40	1,591
	4-567	7/30/17	1,538	-----	Rotary	8 $\frac{1}{2}$	-----	1,532
	4-829	12/ 1/17	1,235	-----	Cable	10	40	1,225
	4-691	9/25/17	1,181	-----	Cable	12 $\frac{1}{2}$	-----	1,171
	4-643	9/ 6/17	1,186	-----	Cable	10	40	1,176
	4-916	1/11/18	1,215	-----	Cable	12 $\frac{1}{2}$	-----	1,2 6
	4-634	5/14/17	1,454	-----	Cable	10	40	1,441
	4-805	12/31/17	1,523	-----	Rotary	10	40	1,523
	4-652	9/10/17	1,548	-----	Rotary	10	40	1,539
	4-964	1/27/18	1,800	Pumping test.	Rotary	10	40	1,450
	4-1123	3/27/18	1,500	Pumping test.	Cable	10	40	1,250
	4 748	10/23/17	1,225	-----	Cable	12 $\frac{1}{2}$	-----	1,210
	4-1127	3/27/18	1,179	Pumping test.	Cable	12 $\frac{1}{2}$	-----	1,057
Sec. 27, T. 31 S., R. 22 E., M. D.	4-1065	3/ 6/18	693	-----	Cable	12 $\frac{1}{2}$	-----	650
	4-900	1/ 2/18	752	-----	Cable	12 $\frac{1}{2}$	-----	741
	4-833	12/ 3/17	937	-----	Cable	12 $\frac{1}{2}$	-----	925
	4-1017	2/19/18	780	-----	Cable	12 $\frac{1}{2}$	-----	770
	4-1254	5/17/18	685	-----	Cable	12 $\frac{1}{2}$	-----	675
	4-1318	6/ 1/18	647	601	Cable	12 $\frac{1}{2}$	-----	598
Sec. 36, T. 31 S., R. 22 E., M. D.	4-778	11/ 5/17	980	-----	Cable	8 $\frac{1}{2}$	32	980
	4-846	12/ 7/17	990	980	Cable	8 $\frac{1}{2}$	32	980
	4-817	12 27/17	1,014	-----	Cable	10	-----	1,010
	4-610	8/21/17	1,190	1,180	Cable	10	-----	1,180
	4-547	7/21/17	1,222	-----	Cable	10	-----	1,214
	4-693	9/26/17	1,510	1,333	Cable	8 $\frac{1}{2}$	-----	1,333
	4-693	9 23/17	1,285	-----	Cable	10	-----	1,285
	4 731	10/15/17	1,295	-----	Cable	10	---	1,291
Sec. 19, T. 31 S., R. 22 E., M. D.	4-926	7 3/17	2,887	-----	Rotary	8 $\frac{1}{2}$	36	2,879
	4 984	9 24/17	3,394	-----	Cable	8 $\frac{1}{2}$	36	3,358
	4 1165	4 11/18	1,223	-----	Cable	6 $\frac{1}{2}$	24	1,223

## NUMBER FOUR—Continued.

Number sacks.	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
Method				
Perkins				Could not bail water down.
60 Perkins				Rise of 36' in 2 hours.
150 Perkins			Bailed to 1,575'. No rise in fluid in 23 hours.	
24 Dump bailer			1' of water in 12 hours.	
27 Dump bailer			2' of water in 20 hours.	
25 Dump bailer			10' of water in 18½ hours.	
25 Dump bailer			4' of water in 24 hours.	
28 Dump bailer			90' of oil; no water in 23½ hours.	
39 Dump bailer			No water in 35 hours.	
40 Dump bailer			2' of water in 19 hours.	
39 Dump bailer			2' of water in 13 hours.	
		Casing froze	42' of oil; 8' of water in 19 hours.	
30 Dump bailer			No water in 15 hours.	
40 Dump bailer			5' oil and water in 13 hours.	
40 Perkins			90' of oil; no water in 15 hours.	
		Landed in blue clay.	3' of water in 7 days.	
		Landed in blue clay.	4' of water in 40½ hours.	
25 Dump bailer			3' of water in 13 hours.	
30 Dump bailer		Landed in blue clay.	Hole bailed to 1,220'. No rise in fluid in 48 hours.	
			No water in 16 hours.	
22 Dump bailer			7' of water in 15 hours.	
100 Huber & Wilson			8' of oil; no water in 24½ hours.	
60 Huber & Wilson				317' fluid in 43 hours.
40 Huber & Wilson			40' of oil; 5' of water in 15½ hrs.	
100 Huber & Wilson			123' of oil; no water in 21½ hours.	
120 Huber & Wilson			212' of oil; no water in 45 hours.	
120 Huber & Wilson			203' of oil; 10' emulsion in 21 hrs.	
120 Huber & Wilson			160' of oil; no water in 18 hours.	
160 Huber & Wilson			800' of oil; 10' of water in 21½ hrs.	
120 Huber & Wilson			800' of oil; no water in 47 hours.	
160 Huber & Wilson				34% water.
120 Huber & Wilson				13 bbls. water per day.
120 Huber & Wilson			85' of oil; no water in 26½ hours.	
25 Huber & Wilson			No water at end of 63 days.	
60 Huber & Wilson			2' of water in 19 hours.	
60 Huber & Wilson			2' of water in 20 hours.	
120 Huber & Wilson, through tubing.			No water in 27½ hours.	
60 Huber & Wilson			No water in 48 hours.	
60 Huber & Wilson			No water in 18 hours.	
60 Huber & Wilson			12' of water in 14 hours.	
120 Huber & Wilson				Company reported water not shut off.
120 Huber & Wilson			70' of oil; no water in 22 hours.	
160 Huber & Wilson			330' of oil; no water in 34 hours.	
100 Huber & Wilson			2' of water in 24 hours.	
100 Huber & Wilson			2' of oil; no water in 20 hours.	
30 Huber & Wilson			200' of oil in 24 hours.	
80 Huber & Wilson				Company reported water not shut off.
20 Dump bailer			10' of oily water in 33 hours.	
8 Scott			No water in 18 hours.	
160 Casing				Could not bail water below 1,500'.
150 Dump bailer			Hole bailed to 3,000'. No change in water level.	

TABLE IV. DISTRICT

Field, section, township, range, or lease	Time report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		
						Diam. (inches)	Weight (pounds)	Length (feet)
Midway—Continued.								
Sec. 25, T. 31 S., R. 23 E., M. D.	4-579	8/ 6/17	2,066	-----	Rotary	8 $\frac{1}{2}$ -7 $\frac{3}{8}$	-----	2,056
	4-746	10/23/17	2,409	-----	Rotary	11	47	2,400
	4-708	10/ 4/17	2,515	-----	Rotary	8 $\frac{1}{2}$	-----	2,485
Sec. 27, T. 31 S., R. 23 E., M. D.	4-1084	3/10/18	1,926	-----	Rotary	10	-----	1,914
	4-1015	2/18/18	3,067	Pumping test.	Rotary	11	47	2,051
Sec. 31, T. 31 S., R. 23 E., M. D.	4-726	10/11/17	2,021	-----	Rotary	10	-----	2,010
	4-522	7-12/17	2,307	2,277	Cable	6 $\frac{1}{2}$	-----	2,277
	4-524	7/16/17	1,150	1,140	-----	10	-----	1,140
	4-507	7/ 7/17	2,280	-----	Cable	8 $\frac{1}{2}$	32	2,276
Sec. 32, T. 31 S., R. 23 E., M. D.	4-509	7/ 7/17	3,179	-----	Cable	8 $\frac{1}{2}$	-----	3,175
	4-823	8/23/17	3,190	-----	Cable	6 $\frac{1}{2}$	-----	3,185
	4-1335	6/11/18	3,497	-----	Cable	6 $\frac{1}{2}$	-----	3,490
Sec. 35, T. 31 S., R. 23 E., M. D.	4-749	10/24/17	2,305	-----	Rotary	11	47	2,300
	4-1104	3/19/18	2,255	-----	Rotary	11	47	2,255
	4-798	11/23/17	2,210	-----	Rotary	11	47	2,200
	4-955	1-24-18	2,131	-----	Rotary	11	47	2,131
	4-927	1/16/18	2,138	-----	Rotary	11	47	2,130
	4-1303	5/27/18	2,139	-----	Rotary	10	-----	2,130
Sec. 36, T. 31 S., R. 23 E., M. D.	4-949	1/21/18	2,310	-----	Rotary	8 $\frac{1}{2}$	-----	2,300
	4-559	7/31/17	2,242	-----	Cable	8 $\frac{1}{2}$	-----	2,235
	4-847	12/ 7/17	2,265	-----	Cable	8 $\frac{1}{2}$	-----	2,250
	4-1031	2/21/18	2,225	-----	Cable	10	-----	2,221
	4-1283	5/23/18	2,607	2,325	Cable	10	-----	2,325
	4-1077	3/ 7/18	2,360	-----	Cable	8 $\frac{1}{2}$	-----	2,352
	4-592	8/11/17	2,512	-----	Rotary	10	-----	2,502
	4-687	9/24/17	2,365	-----	Rotary	8 $\frac{1}{2}$	-----	2,350
	4-764	10/31/17	2,472	-----	Rotary	8 $\frac{1}{2}$	-----	2,457
	4-754	10/25/17	2,304	-----	Rotary	12 $\frac{1}{2}$	-----	2,297
	4-1273	5/21/18	2,495	-----	Rotary	10	-----	2,480
Sec. 31, T. 31 S., R. 24 E., M. D.	4-809	11/26/17	2,310	-----	Rotary	11	47	2,300

## NUMBER FOUR—Continued.

Number sucker.	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
	Method			
35	Perkins		Hole bailed to 1,600'. 5' rise in fluid in 24 hours.	
		Landed in 30' small hole.	Hole bailed to 1,400'. No change in 20 hours.	
70	Perkins		Hole bailed to 1,686'. 20' rise in fluid in 17 hours.	
240	Perkins		Hole bailed to 1,703'. 5' rise in fluid in 14 hours.	
		Landed in blue shale.	Well flowing—188 bbls. fluid. No water at end of 62 days.	
100	Scott		Hole bailed to 1,600'. No rise in water in 18 hours.	
60	Huber & Wilson		20' of water in 18 hours.	
60	Huber & Wilson		4' of oil; no water in 22 hours.	
60	Huber & Wilson		Hole bailed to 1,800'. 2' rise in water in 18½ hours.	
20	Perkins			100' rise in water in 12½ hours.
5	Dump bailer		Hole bailed to 2,655'. No rise in fluid in 28 hours.	
50	Perkins		Hole bailed to 2,190'. No rise in fluid in 22 hours.	
		Landed in hard shale.	Hole bailed to 1,500'. 20' rise in 19 hours.	
		Landed in blue clay.	Hole bailed to 1,600'. 10' rise in fluid in 12½ hours.	
		Landed in blue clay.	Hole bailed to 1,600'. 7' rise in fluid in 18 hours.	
		Landed in blue shale.	Hole bailed to 1,536'. No rise in fluid in 17 hours.	
		Landed in blue shale.	Hole bailed to 1,600'. 15' rise in fluid in 19 hours.	
		Driven in 30' small hole.	Hole bailed to 1,600'. 3' rise in fluid in 28 hours.	
80	Perkins		Hole bailed to 2,010'. 6' rise in fluid in 29 hours.	
00	Perkins		Hole bailed to 1,800'. No rise in fluid in 18 hours.	
55	Perkins		Hole bailed to 2,200'. No rise in fluid in 16 hours.	
		Landed in brown shale.	1' of water in 12½ hours.	
80	Perkins			200' rise in water in 14 hours.
80	Perkins		Hole bailed to 2,100'. 17' rise in fluid in 28 hours.	
240	Perkins		Hole bailed to 2,000'. 3' of water in 10 hours.	
60	Perkins		Hole bailed to 1,997'. 35' rise of oil in 16½ hours.	
80	Perkins		Hole bailed to 2,035'. 2' rise in fluid in 24 hours.	
240	Perkins		Hole bailed to 1,300'. 5' rise in fluid in 25 hours.	
240	Perkins		Hole bailed to 2,000'. 15' rise in fluid in 25½ hours.	
100	Perkins		Hole bailed to 1,600'. 1' of water in 15 hours.	

TABLE IV. DISTRICT

Field, section, township, range, or lease	Report		Depth of hole		Tools	Water string		
	Number	Date	Total drilled (feet)	Bridged to (feet)		Casing		
						Diam. (inches)	Weight (pounds)	Length (feet)
Midway—Continued.								
Sec. 1, T. 32 S., R. 23 E., M. D.	4-638	8/24/17	2,410	-----	Rotary	11	47	2,400
	4-625	8/24/17	2,207	-----	Rotary	11	47	2,200
	4-542	7/19/17	2,250	-----	Rotary	11	47	2,280
Sec. 2, T. 32 S., R. 23 E., M. D.	4-1025	2/20/18	2,637	-----	Rotary	8½	-----	2,632
	4-1360	6-19/18	2,835	-----	Rotary	10	-----	2,820
Sec. 4, T. 32 S., R. 23 E., M. D.	4-1038	2/23/18	3,055	-----	Rotary	8½	-----	3,035
	4-892	12/30/17	3,170	-----	Rotary	10	45	3,160
Sec. 5, T. 32 S., R. 23 E., M. D.	4-994	2/ 5/18	2,240	-----	Rotary	10	-----	2,232
	4-1016	2/19/18	2,104	-----	Rotary	10	-----	2,100
	4-1185	4/18/18	2,036	-----	Rotary	10	-----	2,031
	4-1233	5/ 5/18	1,856	-----	Rotary	10	-----	1,852
	4-1178	4-17-18	2,417	-----	Rotary	10	-----	2,363
	4-1310	5/23/18	2,590	-----	Rotary	8½	-----	2,584
Sec. 6, T. 32 S., R. 23 E., M. D.	4-600	8/14/17	1,975	Pumping test.	-----	10	-----	1,954
	4-537	7/17/17	1,065	-----	Rotary	10	-----	1,010
Sec. 8, T. 32 S., R. 23 E., M. D.	4-899	1/ 2/18	589	-----	Cable	12½	40	584
	4-1206	5/25/18	800	750	Cable	10	40	750
	4-1141	3/31/18	1,200	1,179	Cable	6½	-----	1,179
	4-1125	3/27/18	942	Pumping test.	Cable	12½	40	699
	4-1235	5/ 7/18	935	Pumping test.	Cable	12½	40	659
	4-1218	4/30/18	2,010	-----	-----	10	-----	2,000
	4-1250	5/14/18	1,512	-----	-----	12½	-----	1,497
	4-1115	3/23/18	698	-----	-----	12½	-----	693
	4-1384	6/27/18	732	-----	-----	8½	-----	724
	4-1370	6/21/18	610	-----	-----	12½	-----	635
	4-1350	6/15/18	670	655	-----	12½	-----	655
Sec. 14, T. 32 S., R. 23 E., M. D.	4-1106	3/20/18	2,915	-----	Cable	6½	-----	2,900
	4-527	7/14/17	2,759	-----	Rotary	10	-----	2,750
	4-642	8/30/17	2,866	-----	Rotary	8½	-----	2,860
	4-1045	2/27/18	2,417	-----	Rotary	10	-----	2,410
Sec. 15, T. 32 S., R. 23 E., M. D.	4-1170	4/13/18	1,111	-----	-----	10	-----	1,105
	4-917	1/11/18	869	-----	-----	12½	-----	863
	4-975	1/28/18	806	-----	-----	12½	-----	800
	4-1234	5/ 7/18	785	-----	-----	12½	-----	780
Sec. 23, T. 32 S., R. 23 E., M. D.	4-523	7/16/17	922	-----	Cable	12½	-----	919
	4-692	9/13/17	1,010	-----	Cable	12½	-----	1,001
Sec. 24, T. 32 S., R. 23 E., M. D.	4-582	8/ 7/17	2,319	-----	-----	10	-----	2,315
	4-827	12/ 1/17	2,442	-----	-----	8½	-----	2,435
Sec. 5, T. 32 S., R. 24 E., M. D.	4-969	1/28/18	2,112	-----	Rotary	10	-----	2,092

## NUMBER FOUR—Continued.

Number wells	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
		Landed in blue clay.	Hole bailed to 1,500'. No rise in fluid in 15 hours.	
		Landed in blue shale.	Hole bailed to 936'. 30' rise in fluid in 22 hours.	
		Landed in blue shale.	Hole bailed to 1,500'. 10' rise in fluid in 21½ hours.	
?	Cemented		Hole bailed to 2,000'. No rise in fluid in 17 hours.	
125	Scott		Hole bailed to 1,650'. No rise in fluid in 18½ hours.	
240	Perkins		Hole bailed to 2,200'. 4' rise in fluid in 19½ hours.	
240	Perkins		Hole bailed to 2,200'. No rise in fluid in 13½ hours.	
120	Perkins		Hole bailed to 1,600'. No rise in fluid in 19 hours.	
100	Perkins		Hole bailed to 1,600'. 2' rise in fluid level in 21½ hours.	
160	Perkins		Hole bailed to 1,620'. No change in level in 20 hours.	
80	Perkins		Hole bailed to 1,600'. 5' rise in fluid in 23½ hours.	
120	Perkins		Hole bailed to 1,600'. 7' of water in 12 hours.	
60	Perkins		Hole bailed to 1,600'. No rise in fluid in 24 hours.	
160	Huber & Wilson		40 bbls. fluid; .6% water at end of 5 months.	
60	Huber & Wilson		5 gals. water in 16½ hours.	
		Landed in blue shale.	1' of water in 15½ hours.	
15	Tubing		15' of oil; no water in 14 hours.	
40	Huber & Wilson		3 gals. water in 20 hours.	
120	Huber & Wilson		At end of 143 days, 125 bbls. of oil; no water.	
100	Huber & Wilson		No water at end of 51 days.	
120	Huber & Wilson		5' of water in 21 hours.	
60	Huber & Wilson		No water in 29 hours.	
60	Huber & Wilson			30' of water in 19½ hrs.
60	Huber & Wilson		No water in 20 hours.	
60	Huber & Wilson		2' of oil and water in 13 hours.	
60	Huber & Wilson		1' of oil in 29 hours.	
50	Perkins		Hole bailed to 2,500'. 15' rise in water in 21 hours.	
225	Perkins			400' water in 40 hours.
100	Casing		Hole bailed to 2,300'. 15' rise in water in 17 hours.	
300	Casing		5' of water in 17 hours.	
60	Huber & Wilson		3' of water in 13 hours.	
60	Huber & Wilson		2' of water in 8 days.	
60	Huber & Wilson		No water in 15 hours.	
60	Huber & Wilson		1 gal. of water in 17 hours.	
		Landed in blue shale.	No water in 15½ hours.	
		Landed in blue shale.	20 gals. water in 21 hours.	
200	Perkins		Hole bailed to 1,735'. No rise in fluid in 26 hours.	
80	Perkins		Hole bailed to 1,855'. 3' rise in fluid in 21½ hours.	
100	Scott		Hole bailed to 1,500'. No rise in fluid in 16 hours.	

TABLE IV. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		
						Diam. (inches)	Weight (pounds)	Length (feet)
Midway—Continued.								
Sec. 7, T. 32 S., R. 24 E., M. D.	4-694	9/26/17	2,160	-----	Rotary	11	-----	2,133
	4-1128	3/27/18	2,740	Pumping test.	Cable	8½	-----	2,340
Sec. 9, T. 32 S., R. 24 E., M. D.	4-545	7/23/17	1,977	-----	Rotary	10	-----	1,970
	4-701	9/29/17	2,008	-----	Rotary	10	-----	1,988
	4-788	11/ 8/17	2,374	-----	Rotary	11	47	2,364
	4-911	1/ 9/18	2,320	-----	Rotary	11	-----	2,310
	4-786	11/ 6/17	2,312	-----	Rotary	11	-----	2,302
	4-880	12/21/17	2,235	-----	Rotary	11	-----	2,220
	4-1012	2/18/18	2,169	-----	Rotary	11	-----	2,136
	4-1012	2/18/18	2,195	-----	Rotary	8½	-----	2,182
	4-1132	3/29/18	2,804	Pumping test.	Rotary	11	-----	2,187
Sec. 10, T. 32 S., R. 24 E., M. D.	4-1130	2/21/18	2,510	-----	Rotary	10	-----	2,293
	4-1118	3/26/18	2,214	-----	Rotary	10	-----	2,204
	4-1315	6/ 1/18	1,953	-----	Rotary	10	-----	1,943
Sec. 15, T. 32 S., R. 24 E., M. D.	4-1317	6/ 1/18	2,758	-----	Rotary	10	-----	2,750
	4-873	12/19/17	2,430	-----	Rotary	11	47	2,450
	4-1286	5/23/18	2,554	-----	Rotary	8½	-----	2,550
Sec. 16, T. 32 S., R. 24 E., M. D.	4-775	11/ 3/17	2,920	-----	Cable	8½	36	2,905
	4-1183	4/17/18	3,215	-----	Cable	8½	36	3,250
	4-671	9/18/17	3,365	Produce- tion test.	Rotary	10	45	3,150
	4-515	7/11/17	3,223	-----	Rotary	10	45	3,212
	4-551	7/25/17	3,222	-----	Rotary	10	45	3,210
	4-856	12/12/17	3,270	-----	Rotary	8½	36	3,254
	4-897	1/ 2/18	3,320	-----	Rotary	10	45	3,000
	4-1018	2/19/18	3,470	-----	Rotary	8½	36	3,450
	4-767	9/17/17	3,425	Produce- tion test.	Rotary	10	45	2,931
	4-584	8/ 7/17	2,304	-----	Rotary	8½	32	2,296
	4-637	8/28/17	3,110	-----	Rotary	10	-----	3,100
	4-779	11/ 5/17	3,150	-----	Rotary	10	-----	3,110
	4-1130	3/29/18	3,166	-----	Rotary	8½	-----	3,165
	4-980	9/24/17	2,520	-----	Rotary	11½	-----	2,500
	4-607	8/18/17	3,025	-----	Rotary	10	40-45	3,017
	4-1080	3/ 8/18	2,941	-----	Rotary	10	-----	2,931

## NUMBER FOUR—Continued.

Number wells	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
	Method			
100	Perkins	Landed in blue clay.	Hole bailed to 1,403'. 10' rise in fluid in 24½ hours.	
			At end of 76 days, flowed 300 bbls. of oil; no water.	
100	Scott	Landed in blue shale.	Hole bailed to 1,200'. 20' rise in fluid in 26 hours.	
			Hole bailed to 1,500'. 20' rise in fluid in 16 hours.	
		Driven 30' into formation.	Hole bailed to 1,200'. 8' rise in fluid in 16 hours.	
		Landed in blue clay.	Hole bailed to 1,600'. No rise in fluid in 13 hours.	
		Driven into 30' formation.	Hole bailed to 1,600'. 7' rise in fluid in 23½ hours.	
		Landed in blue shale.	Hole bailed to 1,570'. Showed 7' rise in 18 hours.	
		Casing froze		Company reported no job.
60	Perkins		Hole bailed to 1,610'. 4' rise in fluid in 4 hours.	
		Landed in blue clay.	120 bbls. oil; no water; end of 13 days.	
280	Scott		Hole bailed to 1,505'. 3' rise in fluid in 31 hours.	
90	Tubing		Hole bailed to 1,500'. Showed 5' rise in 11½ hours.	
80	Tubing		Hole bailed to 1,630'. No rise in fluid in 31½ hours.	
		Landed in blue shale.	Hole bailed to 1,775'. No rise in fluid in 16½ hours.	
150	Perkins		Hole bailed to 1,715'. No rise in fluid in 15 hours.	
		Landed in blue clay.	Hole bailed to 1,800'. 7' rise in fluid in 24½ hours.	
100	Perkins		15' drop in fluid in 18½ hours.	
80	Perkins		4' oil and water in 15½ hours.	
240	Perkins		Well flowed 34 bbls. fluid, .1% water.	
240	Perkins			Hole bailed to 2,000'. 185' water in 10 hrs.
200	Perkins		Hole bailed to 224'. 16' rise in fluid in 17 hours.	
80	Perkins		Hole bailed to 2,200'. 4' rise in fluid in 17 hours.	
70	Perkins		Hole bailed to 2,200'. No rise in fluid in 12½ hours.	
70	Perkins		Hole bailed to 2,250'. 20' rise in 16 hours.	
300	Scott		Well flowing at end of 6 months.	
			90 bbls. fluid, .1% water.	
650	Scott		Hole bailed to 1,600'. No change in fluid in 23 hours.	
600	Scott		Hole bailed to 2,346'. 5' rise in fluid in 23½ hours.	
600	Scott		Hole bailed to 2,322'. No rise in water in 22½ hours.	
300	Scott		Hole bailed to 2,000'. 5' fluid rise in 23 hours.	
100	Scott		Hole bailed to 1,692'. No rise in fluid in 16 hours.	
400	Scott		Hole bailed to 2,000'. 12' rise in fluid in 24 hours.	
320	Scott		Hole bailed to 1,752'. 4' rise in fluid in 23 hours.	

TABLE IV. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string				
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing (Diam. inches)	Weight (pounds)	Length (feet)	
Midway -Continued.									
Sec. 17, T. 32 S., R. 24 E., M. D.	4-612	8/21/18	3,218		Rotary	10		3,200	
	4-688	9/24/17	3,255		Rotary	8½		3,250	
	4-630	8/25/17	3,211		Rotary	10		3,201	
	4-620	8/22/17	3,052		Rotary	8½		3,047	
	4-977	1/28/18	3,256		Rotary	10		3,250	
	4-988	1/17/18	2,970		Rotary	10		2,947	
	4-1217	4/30/18	2,868		Rotary	10		2,860	
	4-903	1/ 3/18	2,712		Rotary	10		2,700	
	Sec. 18, T. 32 S., R. 24 E., M. D.	4-504	7/ 7/17	3,135		Rotary	10		3,125
		4-505	8/11/17	3,008	2,995	Cable	8½		2,995
4-605		11/23/17	3,239		Cable	6½		3,225	
Sec. 19, T. 32 S., R. 24 E., M. D.	4-812	11/25/17	2,305		Rotary	10		2,305	
	4-812	11/25/17	2,371		Rotary	8½		2,367	
	4-1159	4/10/18	2,173		Rotary	10		2,170	
	4-1262	5/20/18	2,158		Cable	8½		2,154	
	4-596	8/13/18	2,850		Rotary	10		2,850	
	4-576	8/ 3/17	2,745		Rotary	10		2,725	
	4-609	8/18/17	2,746			8½		2,743	
Sec. 21, T. 32 S., R. 24 E., M. D.	4-1151	4/ 4/18	3,152		Rotary	10		3,150	
	4-1174	4/16/18	3,261		Rotary	10		3,256	
Sec. 28, T. 32 S., R. 24 E., M. D.	4-669	9/18/18	3,185		Rotary	10	45	3,072	
Sec. 30, T. 32 S., R. 24 E., M. D.	4-1043	2/25/18	2,020		Cable	8½		1,960	
	4-645	9/ 6/17	2,225		Rotary	10	45	2,210	
	4-912	1/18/18	2,225		Rotary	10	45	2,214	
	4-1046	2/27/18	2,250		Rotary	8½		2,241	
	4-736	10/15/17	2,315		Rotary	8½		2,300	
	4-745	10/23/17	1,340		Rotary	12½		1,330	
Sec. 33, T. 32 S., R. 24 E., M. D.	4-835	12/ 4/17	1,615	1,608	Rotary	10		1,608	
	4-1333	6/10/18	2,153		Rotary	10		2,150	
	4-591	8/11/17	2,264			8½		2,261	
Sec. 34, T. 32 S., R. 24 E., M. D.	4-729	10/11/17	2,990		Cable	8½		2,987	
	4-810	11/26/17	2,990		Cable	8½		2,987	
	4-1111	3/22/18	3,003		Cable	6½		3,086	
Sunset—									
Sec. 4, T. 11 N., R. 23 W., S. B.	4-599	8/ 1/17	2,501		Rotary	10	40	2,501	
	4-599	8/ 1/17	2,589	Production test.	Rotary	8½		2,574	

## NUMBER FOUR—Continued.

Number wells	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
Method				
110 Perkins	-----	-----	-----	500' water in 16½ hrs.
20 Perkins	-----	-----	-----	4 bbls. water per day.
100 Perkins	-----	-----	Hole bailed to 1,600'. 10' rise in fluid in 16½ hours.	
70 Perkins	-----	-----	Hole bailed to 1,600'. No rise in fluid in 26 hours.	
150 Perkins	-----	-----	Hole bailed to 1,700'. 10' rise in fluid in 20 hours.	
150 Perkins	-----	-----	-----	12' rise in 6½ hours.
150 Perkins	-----	-----	Hole bailed to 1,720'. 6' rise in fluid in 26½ hours.	
150 Perkins	-----	-----	Hole bailed to 1,700'. No rise in fluid in 17½ hours.	
240 Perkins	-----	-----	Hole bailed to 2,200'. No rise in fluid in 28½ hours.	
30 Dump bailer	-----	-----	Hole bailed to 2,200'. 42' rise in oil in 22 hours.	
30 Dump bailer	-----	-----	Hole bailed to 2,450'. No rise in fluid in 13 hours.	
100 Perkins	-----	-----	-----	Company reported no job.
60 Perkins	-----	-----	-----	500' fluid in 18 hours.
150 Perkins	-----	-----	Hole bailed to 1,600'. 2' rise in fluid in 18½ hours.	
30 Perkins	-----	-----	Hole bailed to 1,600'. 15' rise in fluid in 19½ hours.	
100 Perkins	-----	-----	Hole bailed to 1,700'. 15' rise in fluid in 22 hours.	
100 Perkins	-----	-----	-----	90' fluid in 11½ hours.
30 Perkins	-----	-----	Hole bailed to 1,715'. 5' rise in fluid in 16 hours.	
150 Perkins	-----	-----	Hole bailed to 1,800'. 1' rise in fluid in 18½ hours.	
150 Perkins	-----	-----	Hole bailed to 1,700'. 15' rise in water in 29 hours.	
300 Perkins	-----	-----	At end of 9 months pumping 73 bbls. fluid; 1.4% water.	
Perkins	-----	-----	At end of 92 days well pumped 35 bbls. fluid; 1% water.	
200 Perkins	-----	-----	Hole bailed to 1,800'. No rise in fluid in 8 hours.	
200 Perkins	-----	-----	-----	975' rise in 18½ hours.
35 Dump bailer	-----	-----	Hole bailed to 2,000'. 70' rise in oil in 15½ hours.	
200 Perkins	-----	-----	Hole bailed to 2,025'. No rise in fluid in 29½ hours.	
100 Perkins	-----	-----	-----	Water broke in—no job.
70 Perkins	-----	-----	45' oil; no water in 48 hours.	
120 Perkins	-----	-----	Hole bailed to 1,600'. 10' rise in fluid in 24 hours.	
30 Perkins	-----	-----	Hole bailed to 1,800'. 10' rise in fluid in 23 hours.	
50 Perkins	-----	-----	-----	Flowed salt water.
16 Recement; dump bailer.	-----	-----	Hole bailed to 1,240'. No change in fluid in 27½ hours.	
20 Perkins	-----	-----	Hole bailed to 1,650'. 10' rise in fluid in 12 hours.	
Perkins	-----	-----	-----	Company reported no job.
50 Perkins	-----	-----	-----	6% water, 11% emulsion.

TABLE IV. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		
						Phm. (inches)	Weight (pounds)	Length (feet)
Sunset—Continued.								
Sec. 4, T. 11 N., R. 23 W., S. B.	4-874	12/19/17	3,002	-----	Cable	6½	-----	2,993
	4-568	8/ 1/17	2,615	-----	Rotary	10	40	2,604
	4-553	7/23/17	2,417	Produ- tion test.	Rotary	10	40	2,394
	4-676	9/20/17	2,411	-----	Rotary	10	40	2,408
	4-796	11/23/17	2,839	-----	Rotary	8½	-----	2,832
	4-815	11/27/17	2,408	-----	Rotary	10	40	2,391
	4-1252	5/17/18	2,580	2,557	Rotary	8½	-----	2,549
	4-1252	5/17/18	2,580	2,557	Rotary	8½	-----	2,549
	4-1252	5/17/18	2,580	2,557	Rotary	8½	-----	2,549
	4-1173	4/13/18	3,078	-----	Rotary	8½	-----	3,073
	4-1655	3/ 3/18	2,603	-----	Rotary	10	40	2,598
	4-675	9/19/17	2,958	-----	Cable	6½	-----	2,950
	4-575	8/ 3/17	3,015	-----	Cable	6½	-----	3,005
	4-552	7/26/17	2,540	Produ- tion test.	Rotary	10	40	2,512
	4-1321	6/ 4/18	2,407	Produ- tion test.	Cable	8½	-----	2,388
	4-1163	4/11/18	2,445	-----	Rotary	10	40	2,439
	4-802	11/23/17	3,195	-----	Rotary	8½	-----	3,175
	4-851	12/11/17	2,761	-----	Cable	8½	-----	2,757
	4-514	7/10/17	3,246	-----	Cable	8½	-----	3,234
Sec. 5, T. 11 N., R. 23 W., S. B.	4-987	2/ 1/18	2,351	-----	Cable	8½	-----	2,344
	4-598	8/13/17	2,313	-----	Rotary	11	47	2,301
	4-787	11/ 6/17	2,670	-----	Cable	8½	38-28	2,666
	4-936	1/17/18	2,753	-----	Cable	6½	-----	2,743
	4-1033	2/21/18	2,338	-----	Cable	8½	-----	2,335
	4-538	7/16/17	2,865	-----	Cable	8½	-----	2,860
	4-861	12/13/17	2,391	-----	Cable	8½	-----	2,389
	4-773	10/30/17	2,254	Produ- tion test.	Rotary	11	47	2,223
	4-1175	4/16/18	2,244	-----	Rotary	10	40	2,237
	4-1300	5/25/18	2,246	-----	Rotary	10	40	2,244
	4-891	12/30/17	2,461	-----	Rotary	11	47	2,361
	4-891	12/30/17	2,461	-----	Cable	8½	-----	2,458
Sec. 6, T. 11 N., R. 23 W., S. B.	4-995	9/23/17	2,238	-----	Cable	8½	-----	2,234
Sec. 7, T. 11 N., R. 23 W., S. B.	4-1071	3/ 6/18	2,402	-----	Cable	6½	-----	2,400
	4-1044	2/25/18	1,360	Produ- tion test.	Cable	10	40	1,328
	4-875	12/20/17	1,237	-----	Cable	10	40	1,232
	4-858	12/13/17	1,395	-----	Cable	12½	50	1,374
	4-931	1/13/18	1,432	-----	Cable	10	40	1,426
	4-1268	4/25/18	1,294	Produ- tion test.	Cable	12½	50	1,264
	4-1351	6/15/18	1,288	-----	Cable	12½	50	1,268

## NUMBER FOUR—Continued.

Number sacks	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
	Method			
100	Perkins		Hole bailed to 200'. 3' rise in fluid in 27 hours.	
140	Scott			100' water in 24 hrs.
120	Perkins		200 bbls. fluid; 1.6% water.	
120	Perkins			180' water in 16½ hrs.
110	Perkins		Hole bailed to 2,002'. No rise in fluid in 15 hours.	
100	Perkins			75' water per hour.
45	Perkins			Company reported water broke in.
	Re-cement, 8 c: pressure.			Company reported no job.
	Re-cement, 8 c: pressure.			Company reported no job.
110	Perkins			Flowed 1,000 bbls. water per day.
120	Perkins			370' water in 22 hours.
160	Perkins		Hole bailed to 2,020'. No rise in fluid in 12 hours.	
90	Perkins		Hole bailed to 2,013'. 2' rise in fluid in 25 hours.	
120	Perkins		After 2 days well produced 133 bbls. oil; 4% water.	
12	Drove casing, dump bailer.		Small amount of water in hole.	
		Landed in blue shale.		Company reported water not shut off.
135	Scott		No water in 14 hours.	
		Landed in blue clay.	Hole bailed to 1,500'. No rise in fluid in 13½ hours.	
100	Scott		Hole bailed to 1,490'. 1' rise in fluid in 19 hours.	
30	Perkins		Hole bailed to 1,620'. 2' rise in fluid in 19 hours.	
160	Perkins			Water broke in.
80	Perkins		Hole bailed to 1,600'. 31' rise in oil in 24 hours.	
30	Perkins		Hole bailed to 1,800'. 15' rise in fluid in 18 hours.	
30	Perkins		Hole bailed to 1,600'. 4' rise in fluid in 21 hours.	
120	Perkins		Hole bailed to 1,950'. No rise in fluid in 21 hours.	
80	Perkins		Hole bailed to 1,650'. 5' rise in fluid in 18 hours.	
130	Scott		Well made 458 bbls. fluid, 1% water.	
50	Perkins			Cement did not set.
50	Perkins			800' water in 19 hours.
130	Perkins			Water broke in.
60	Perkins		Hole bailed to 1,700'. 330' oil; no water in 12½ hours.	
30	Scott		Hole bailed to 1,600'. 15' rise in water in 21½ hours.	
11	Dump bailer			Water broke in.
20	Dump bailer		At end of 134 days made 125 bbls. per day; 1.2% water.	
100	Perkins		No water in 22½ hours.	
200	Perkins			225' water in 13 hours.
40	Dump bailer		600' oil; no water in 22 hours.	
110	Perkins			2 bbls. water per day.
100	Perkins		234' oil; no water in 13 hours.	

TABLE IV. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		
						Diam. (inches)	Weight (pounds)	Length (feet)
Sunset—Continued.								
Sec. 2, T. 11 N., R. 24 W., S. B.	4-573	7/28/17	418	-----	Cable	12½	50	414
	4-512	7/10/17	495	-----	Cable	12½	50	487
	4-541	7/19/17	513	-----	Cable	12½	50	500
	4-951	1/21/18	865	-----	Cable	12½	50	684
	4-1256	5/18/18	870	743	Cable	10	-----	730
Sec. 3, T. 11 N., R. 24 W., S. B.	4-581	8/ 7/17	297	-----	Cable	11½	-----	274
Sec. 12, T. 11 N., R. 24 W., S. B.	4-502	6/ 7/17	950	959	Cable	8½	28	959
	4-1250	5/23/18	1,045	1,022	Cable	8½	28	1,022
Sec. 30, T. 12 N., R. 23 W., S. B.	4-539	7/16/17	2,645	-----	Cable	8½	-----	2,640
Sec. 31, T. 12 N., R. 23 W., S. B.	4-1078	3/ 7/18	1,920	-----	Rotary	12½	-----	1,918
	4-832	12/ 3/17	1,660	-----	Rotary	11	-----	1,654
	4-757	10/26/17	1,025	-----	Rotary	10	-----	1,025
	4-939	1/17/18	1,595	Production test.	Rotary	8½	-----	1,400
	4-697	9/27/17	951	-----	Rotary	10	-----	948
	4-742	10/20/17	1,077	-----	Cable	8½	-----	1,074
	4-587	8/ 8/17	1,556	-----	Rotary	12½	-----	1,550
	4-747	10/23/17	1,632	-----	Rotary	10	-----	1,625
	4-860	12/13/17	2,040	-----	Cable	6½	-----	2,036
	4-566	7/31/17	1,740	-----	Rotary	12½	-----	1,729
Sec. 32, T. 12 N., R. 23 W., S. B.	4-1050	3/ 3/18	2,532	-----	-----	10	-----	2,527
	4-914	1/11/18	2,930	-----	Cable	4½	-----	2,920
Sec. 23, T. 12 N., R. 24 W., S. B.	4-740	10/18/17	1,815	-----	Rotary	12½	-----	1,805
	4-888	12/28/17	1,600	-----	Rotary	12½	-----	1,684
Sec. 35, T. 12 N., R. 24 W., S. B.	4-1243	5/ 8/18	515	-----	Cable	10	-----	505
Sec. 36, T. 12 S., R. 24 W., S. B.	4-968	1/ 2/18	916	-----	Cable	10	-----	911
	4-665	9/14/17	1,055	Production test.	Rotary	12½	50	734
	4-1319	6/ 1/18	930	836	Rotary	12½	50	833
	4-949	9/10/17	1,634	-----	Rotary	10	-----	1,625
Sec. 36, T. 12 S., R. 24 W., S. B.	4-985	1/31/18	1,500	Production test.	Rotary	12½	50	1,350
	4-682	9/24/17	1,307	-----	Rotary	12½	50	1,300
	4-988	2- 1-18	935	-----	Rotary	12½	50	900
	4-988	2/ 1/18	935	-----	Rotary	12½	50	932
	4-821	11/27/17	1,315	1,295	Rotary	12½	50	1,295
	4-986	1/31/18	1,260	-----	Rotary	12½	50	1,250
	4-1037	2/23/18	1,258	-----	Rotary	12½	50	1,250
	4-1061	3/ 3/18	1,260	-----	Rotary	12½	50	1,250
	4-1230	5/ 3/18	1,260	-----	Rotary	10	-----	1,300

## NUMBER FOUR—Continued.

Number Sects.	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
Method				
		Landed in shale.	10' oil and water in 17 hours.	
120 Perkins			1' water in 10½ hours.	
100 Perkins				2 bbls. water in 12 hrs.
100 Perkins			50' oil; no water in 26 hours.	
50 Dump bailer			5' of water in 25 hours.	
		Landed in blue clay.	3 bbls. water in 54 hours.	
		Driven 2' into brown shale.	No water in 8 hours.	
		Landed in shale.	No water in 14 hours.	
20 Scott				Company reported water not shut off.
160 Perkins			Hole bailed to 1,800'. 4' rise in fluid in 21 hours.	
130 Perkins			No water in 18 hours.	
Perkins				Company reported no job.
150 Perkins			At end of 40 days well made 75 bbls. of oil; no water.	
90 Perkins				Company reported no job.
40 Perkins			Hole bailed to 1,000'. No change in fluid in 19 hours.	
100 Perkins			Hole bailed to 800'. No change in fluid in 8 hours.	
60 Perkins			Hole bailed to 1,005'. No change in fluid in 22½ hours.	
40 Perkins			Hole bailed to 1,600'. No change in fluid in 18 hours.	
103 Perkins			Hole bailed to 1,200'. No change in fluid in 24 hours.	
200 Scott			Hole bailed to 2,000'. No change in fluid in 13 hours.	
100 Scott			Hole bailed to 1,800'. 18' rise in fluid in 14 hours.	
240 Perkins			Hole bailed to 1,250'. 25' rise in oil in 18 hours.	
200 Perkins				Company reported water broke in.
		Landed in blue shale.	2' water in 20 hours.	
80 Perkins			15' oil; no water in 13½ hours.	
100 Perkins			At end of 92 days pumped 40 bbls. fluid per day; 8% water.	
125 Perkins			No water in 35 hours.	
25 Dump bailer			17' rise in fluid in 14 hours.	
120 Perkins			End of 146 days made 32 bbls. fluid; 3.3% water.	
200 Perkins			5 gals. water in 10 hours.	
140 Perkins				Company reported no job.
30 Dump bailer			No water in 13½ hours.	
240 Perkins			No water in 30 hours.	
120 Perkins				Could not lower water.
20 Dump bailer				Could not lower water.
100 Pumped through tubing; 600# pres.				Could not lower water.
40 Dump bailer				Could not lower water.

TABLE IV. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string				
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing			
						Di- am. (inches)	Weight (pounds)	Length (feet)	
Kern River—									
Sec. 27, T. 28 S., R. 27 E., M. D.	4-90	5/23/18	2,369	Produc- tion test.	Rotary	10	45	2,345	
	4-97	6/12/18	2,379		Cable	8½	---	2,378	
Sec. 29, T. 28 S., R. 27 E., M. D.	4-13	9/12/17	3,073	-----	Cable	8½	---	3,073	
	4-66	2/18/18	2,989	-----	Cable	8½	---	2,985	
	4-88	5/ 8/18	3,046	-----	Cable	6½	---	3,043	
Sec. 36, T. 28 S., R. 27 E., M. D.	4-8	8/16/17	1,094	-----	Cable	8½	---	1,087	
	4-37	11/24/17	633	-----	Cable	12½	---	658	
Sec. 19, T. 28 S., R. 28 E., M. D.	4-60	1/31/18	985	Produc- tion test.	Cable	10	---	769	
Sec. 20, T. 28 S., R. 28 E., M. D.	4-86	5/ 8/18	834		710	Cable	9½	---	704
	4-2	7/10/17	709	-----	Cable	11½	---	706	
	4-9	8/24/17	720	-----	Cable	9½	---	715	
	4-85	5/ 8/18	700	-----	Cable	11½	---	690	
	4-94	6/ 5/18	688	-----	Cable	11½	---	686	
	Sec. 29, T. 28 S., R. 28 E., M. D.	4-5	7/21/17	474	-----	Cable	12½	---	469
4-26		11/ 5/17	471	-----	Cable	11½	---	467	
Sec. 30, T. 28 S., R. 28 E., M. D.	4-65	2/18/18	1,020	Produc- tion test.	Cable	10	---	808	
	4-7	7/23/17	702		Cable	10	---	789	
	4-4	7/21/17	547		Cable	12½	---	540	
Sec. 31, T. 28 S., R. 28 E., M. D.	4-10	8/25/17	543	-----	Cable	10	---	540	
	4-1	7/ 5/17	635	-----	Cable	11½	---	632	
Sec. 3, T. 29 S., R. 28 E., M. D.	4-51	1/18/18	100	-----	Cable	11½	40	75	
	4-75	3/29/18	104	-----	Cable	11½	40	100	
	4-93	5/28/18	130	-----	Cable	11½	40	127	
	4-92	5/28/18	117	-----	Cable	13½	---	85	
Sec. 4, T. 29 S., R. 28 E., M. D.	4-87	5/ 9/18	294	-----	Cable	9½	---	290	
Sec. 5, T. 29 S., R. 28 E., M. D.	4-102	6/27/18	552	-----	Cable	11½	40	550	
Sec. 6, T. 29 S., R. 28 E., M. D.	4-18	9/27/18	810	-----	Cable	9½	---	771	
	4-82	4/27/18	857	-----	Cable	10	40	853	
Sec. 9, T. 29 S., R. 28 E., M. D.	4-12	9/ 5/17	457	-----	Cable	11½	---	454	
	4-23	10/ 7/17	530	382	Cable	11½	---	382	
	4-25	10/16/17	390	-----	Cable	11½	---	394	
	Sec. 10, T. 29 S., R. 28 E., M. D.	4-36	11/21/17	210	-----	Cable	7½	---	208
	4-46	1/15/18	187	-----	Cable	7½	---	181	
	4-70	3/13/18	201	-----	Cable	8½	---	196	
	4-83	5/ 1/18	171	-----	Cable	7½	---	161	

## NUMBER FOUR—Continued.

Shut-off			Result	
Number shots.	Cement		Success	Failure
	Method	Formation shut-off		
160	Perkins		30 bbls. fluid; 1.8% water.	
8	Dump bailer		Hole bailed to 2,655'. No change in fluid in 7 hours.	
60	Huber & Wilson			Could not bail down. Water broke in. Water broke in.
120	Perkins			
80	Perkins			
100	Perkins		No water in 24½ hours. No water in 39½ hours.	
		Driven into blue clay.		
8	Dump bailer		10 bbls. oil; no water.	
30	Pumped through tubing.		10' water in 21 hours.	
		Landed in clay.	No water in 18 hours.	
		Driven into clay.	No water in 26½ hours.	
		Landed in clay.	No water in 13½ hours.	
		Landed in clay.	1' of water in 24 hours.	
		Landed in blue clay.	No water in 17½ hours.	
		Landed in blue clay.	No water in 23 hours.	
100	Perkins		3 bbls. oil; no water.	
100	Perkins		No water in 22½ hours. No water in 16 hours.	
		Landed in blue clay.		
60			No water in 49½ hours.	
60			No water in 72 hours. No water in 24 hours.	
		Landed in clay.		
		Landed in clay.	3' water in 25 hours.	
		Landed in clay.	3' water in 24 hours.	
		Landed in clay.	No water in 23½ hours.	
		Landed in clay.	No water in 20½ hours.	
		Landed in clay.	6' water in 22½ hours.	
	Perkins		No water in 12 hours.	
100	Pumped through tubing.		4' water in 17 hours.	
		Landed in clay.		Water broke in; 180' in 5 minutes. Water broke in.
50	Pumped through tubing.			
		Driven 3' in blue clay.	No water in 8 hours.	
		Driven into clay.	No water in 23½ hours.	
		Driven into clay.	No water in 26 hours.	
		Driven into clay.	No water in 24 hours.	
		Driven into clay.	No water in 24 hours.	

TABLE V. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		Length (feet)
						Diam. (inches)	Weight (pounds)	
Coalinga—								
Sec. 2, T. 19 S., R. 15 E., M. D.	5-135	3/21/18	1,752		Rotary	10	40	1,750
	5-172	5/ 4/18	2,078		Rotary	10	40	2,073
	5-200	6/19/18	1,980		Rotary	10	40	1,974
Sec. 10, T. 19 S., R. 15 E., M. D. Sec. 11, T. 19 S., R. 15 E., M. D.	5-46	10/12/17	2,200		Rotary	8 $\frac{1}{4}$		2,195
	5-39	8/18/17	1,160		Rotary	10	40	1,050
	5-112	12/20/17	1,412		Rotary	10	40	1,408
	5-127	1/16/18	1,407		Rotary	10	40	1,403
	5-87	11/17/17	1,877		Cable	8 $\frac{1}{4}$	36	1,875
	5-88	11/19/17	2,041		Rotary	11	47	2,035
	5-61	10/ 4/17	2,231		Rotary	10	40	2,226
	5-163	4/ 4/18	1,736		Rotary	10	40	1,731
	5-183	5/11/18	1,770		Rotary	8 $\frac{1}{4}$	36	1,768
	5-193	6/ 6/18	2,011	1,900	Cable	8 $\frac{1}{4}$		1,900
Sec. 12, T. 19 S., R. 15 E., M. D.	5-142	2/26/18	3,035		Rotary	10	40	3,029
	5-164	4/ 4/18	3,066		Cable	8 $\frac{1}{4}$	36	3,064
	5-199	5/25/18	3,066		Cable	8 $\frac{1}{4}$	36	3,065
Sec. 13, T. 19 S., R. 15 E., M. D.	5-156	3/22/18	3,071	3,043	Cable	8 $\frac{1}{4}$	36	3,043
Sec. 14, T. 19 S., R. 15 E., M. D.	5-31	8/ 8/17	2,038		Rotary	10	45-48	2,036
	5-117	12/31/17	2,193		Rotary	10	45	2,183
							6'	
	5-52	9/17/17	2,280		Rotary	10	45-48	2,276
	5-62	10/ 6/17	2,287		Rotary	10	48	2,284
	5-99	11/20/17	2,407		Rotary	10	45-48	2,404
	5-108	12/15/17	2,424		Cable	8 $\frac{1}{4}$	28-32	2,422
	5-96	12/ 6/17	2,398		Rotary	10	45-48	2,396
	5-98	12/ 6/17	2,380		Rotary	10	45-48	2,376
	5-103	12/12/17	2,181		Rotary	10	45-48	2,176
	5-104	12/13/17	2,104		Rotary	10	45-48	2,100
	5-109	12/15/17	1,968		Rotary	10	45-48	1,965
	5-131	1/26/18	2,058		Rotary	10	45-48	2,055
	5-203	6/25/18	1,928		Rotary	10	45	1,925
	5-186	5/22/18	2,742		Rotary	10	45	2,740
	5-191	6/ 3/18	1,094		Cable	10		1,091
	5-95	11/30/17	1,047		Cable	8 $\frac{1}{4}$		1,042
	5-174	5/ 7/18	1,297		Cable	8 $\frac{1}{4}$		1,292
	5-73	10/26/17	1,175		Cable	8 $\frac{1}{4}$		1,170
Sec. 22, T. 19 N., R. 15 E., M. D.								
	5-73	10/26/17			Rotary	10		1,150
	5-84	11/16/17	1,148		Rotary	10	47	1,143
	5-116	12/27/17	1,020		Rotary	10		1,014
	5-129	1/19/18	1,063		Cable	8 $\frac{1}{4}$		1,058
	5-102	12/11/17	1,449		Cable	8 $\frac{1}{4}$	28	1,440
	5-118	12/31/17	1,297		Rotary	10		1,294
	5-151	3/15/18	1,333		Rotary	10		1,326
	5-178	5/11/18	1,385		Cable	8 $\frac{1}{4}$		1,378
	5-114	12/21/17	2,010		Cable	8 $\frac{1}{4}$		1,990
Sec. 26, T. 19 S., R. 15 E., M. D.								
	5-21	7/20/17	2,375		Rotary	10	45-48	2,370
	5-26	7/30/17	2,354		Rotary	10	45-48	2,351
	5-139	2/16/18	3,102		Rotary	10	45-48	3,100
	5-137	2/ 7/18	2,009		Rotary	10	45-48	2,007
	5-165	4/ 5/18	2,113		Rotary	10	45-48	2,110
	5-29	7/ 6/17	1,453		Cable	10	45	1,450
	5-18	7/17/17	1,642		Cable	10		1,640
	5-18	7/17/17			Rotary	12 $\frac{1}{2}$		1,233
Sec. 27, T. 19 S., R. 15 E., M. D.								
	5-24	7/28/17	1,206		Rotary	12 $\frac{1}{2}$	40	1,203

NUMBER FIVE; see page 110.

Number Sticks	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
	Method			
306	Perkins	-----	40' of water in 17 hours.	
300	Perkins	-----	Hole bailed to 1,750'; 1' of water in 23 hours.	
300	Perkins	-----	Hole bailed to 1,700'; 36' of fluid, 50% water, 19 hours.	
10	Dump bailer	-----	21' of water in 41 hours.	
160	Perkins	-----	Lead line test showed 8% water.	
160	Perkins	-----	3 gals. water in 29 hours.	
16	Dump bailer	-----	1 gal. water in 16 hours.	
200	Perkins	-----	3 gals. water in 16 hours.	
200	Perkins	-----	$\frac{1}{2}$ bailer water in 14 hours.	75' water in 17 hours.
70	Perkins	-----		101' water in 23 hrs.
72	Dump bailer	-----	12' water in 24 hours.	
30	Dump bailer	-----	25' water in 27 hours.	
150	Perkins	-----		Could not bail down.
15	Dump bailer	-----		12 gals. water per hr.
24	Recemented dump bailer.	-----	Hole bailed to 2,000'; 115' sulphur water came in.	
60	Perkins	-----	Pumping test, 200 bbls. fluid; 5% water.	
200	Perkins	-----	22' oil, no water, 12 hours.	
130	Pumped through tubing.	-----	2' water in 19 hours.	
200	Perkins	-----	Fluid rise to 1,430'; no water on bottom.	
200	Perkins	-----	5' water in 12 hours.	
201	Perkins	-----	3 gals. water in 17 hours.	
30	Dump bailer	-----	2' water in 20 hours.	
201	Perkins	-----	No free water at test.	
200	Perkins	-----	3 gals. water in 13 hours.	
200	Perkins	-----	Sand and oil, no water, 18 hours.	
200	Perkins	-----	8 gals. water in 13 hours.	
200	Perkins	-----	20' fluid, 10% water, 16 hours.	
200	Perkins	-----	10 gals. water in 14 hours.	
200	Perkins	-----	25' of water in 16 hours.	
200	Perkins	-----	22' of water in 22½ hours.	
22	Dump bailer	-----	1 gal. water in 42 hours.	
30	Dump bailer	-----	1' dry sand, 22 hours.	
40	Dump bailer	-----	6' water in 19 hours.	
40	Dump bailer	-----	85' oil, no water, in 12 hours.	
				Company reported water not shut off.
140	Perkins	-----	1' water in 19 hours.	
140	Perkins	-----		60' water in 12 hours.
35	Dump bailer	-----	$\frac{1}{2}$ gal. water in 13 hours.	
30	Perkins	-----	30' of oil, no water, 17 hours.	
60	Perkins	-----	3 gals. mud in 17 hours.	
60	Perkins	-----	90' of oil, no water, 24 hours.	
60	Perkins	-----	150' of oil, no water, in 24 hrs.	
105	Pumped through tubing.	-----		$\frac{1}{2}$ bailer water per hr.
157	Perkins	-----	12 gals. water in 19 hours.	
200	Perkins	-----	4' of water in 18 hours.	
200	Perkins	-----	Hole bailed to 2,300'; rise of 12' in 30 hours.	
200	Perkins	-----	2 gals. water in 12 hours.	
200	Perkins	-----	1 gal. mud in 13½ hours.	
60	Perkins	-----	16 gals. water in 34 hours.	
58	Perkins	-----	4' of water in 14 hours.	
				Company reported water not shut off.
108	Perkins	-----	Hole bailed to 1,000'; 5' rise in fluid in 28 hours.	

TABLE V. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing Diam. (inches)	Weight (pounds)	Length (feet)
Coalinga—Continued—								
Sec. 27, T. 19 S., R. 15 E., M. D.	5-48	9/10/17	1,488	-----	Cable	10	45	1,485
	5-45	9/ 5/17	2,013	-----	Rotary	10	45	2,011
	5-44	8/31/17	1,934	-----	Rotary	10	45	1,930
	5-65	10/12/17	1,855	-----	Rotary	10	45	1,851
	5-64	10/10/17	1,941	-----	Rotary	10	45	1,938
	5-78	11/ 5/17	1,636	-----	Rotary	10	45	1,631
	5-86	11/17/17	1,650	-----	Cable	8½	32-36	1,648
	5-119	1/ 2/18	1,842	-----	Rotary	10	45-48	1,840
	5-143	2/27/18	1,948	-----	Rotary	10	48	1,945
	5-150	3/15/18	1,535	-----	Rotary	10	45	1,533
	5-189	5/28/18	1,523	-----	Rotary	10	45	1,520
	5-158	3/26/18	1,568	-----	Rotary	10	45	1,565
	5-176	5/ 6/18	1,542	-----	Rotary	10	40-45	1,540
	5-167	4/11/18	1,553	-----	Rotary	10	40-45	1,550
Sec. 28, T. 19 S., R. 15 E., M. D.	5-196	6/12/18	1,507	-----	Rotary	10	40-48	1,505
	5/195	6/13/18	1,315	-----	Rotary	10	45	1,313
	5-16	7/14/17	714	-----	Cable	12½	-----	711
	5-57	9/27/17	1,374	-----	Cable	10	40-45	1,369
	5-101	12/10/17	2,755	-----	Cable	8½	-----	2,750
	5-68	10/15/17	2,699	-----	Rotary	10	48	2,696
Sec. 29, T. 19 S., R. 15 E., M. D.	5-105	12/13/17	2,699	2,672	Rotary	10	48	2,655-
	5-134	2/ 2/18	2,743	-----	Cable	8½	-----	2,733
Sec. 31, T. 19 S., R. 15 E., M. D.	5-147	3/ 5/18	1,265	-----	Cable	10	-----	1,261
Sec. 32, T. 19 S., R. 15 E., M. D.	5-197	6/16/18	2,020	-----	Rotary	10	40	2,014
	5-76	11/ 1/17	1,990	-----	Rotary	10	40	1,985
	5-111	12/19/17	2,073	-----	Rotary	10	40	2,067
	5-125	1/10/18	2,168	-----	Rotary	10	40	2,161
	5-148	3/ 6/18	2,265	-----	Rotary	10	40	2,259
	5-181	5/13/18	2,370	-----	Rotary	10	40	2,364
	5-46	9/ 8/17	1,946	-----	Rotary	10	40-45	1,940
	5-133	2/ 1/18	1,911	-----	Rotary	10	-----	1,894
	5-82	11/12/17	2,020	-----	Rotary	10	47	2,012
	5-106	12/14/17	2,210	-----	Rotary	10	45	2,201
	5-67	10/12/17	2,125	-----	Rotary	10	40-45	2,112
	5-27	8/ 1/17	2,093	-----	Rotary	10	40-45	2,088
	5-123	1/ 9/18	2,323	-----	Rotary	8½	-----	2,316
	5-198	6/15/18	2,254	-----	Rotary	10	40-45	2,234
	5-185	5/22/18	2,221	-----	Rotary	8½	-----	2,216
	5-92	11/23/17	2,428	-----	Rotary	10	-----	2,428
	5-92	11/23/17	2,456	-----	Cable	9½	-----	2,453
	5-213	1/ 9/18	2,323	-----	Rotary	10	-----	2,226

## NUMBER FIVE—Continued.

Number sacks-----	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
Method				
60 Perkins -----			5' water in 28 hours.	
200 Perkins -----			Hole bailed to 1,500'; 40' rise in fluid, oil, 16 hours.	
198 Perkins -----			5' water in 15 hours.	
200 Perkins -----			5' oil and water in 20 hours.	
200 Perkins -----			1 gal. water in 12 hours.	
200 Perkins -----			Hole bailed to 1,177'; water came in from below shoe.	
20 Dump bailer -----			1 qt. oil in 17 hours.	
200 Perkins -----			2 gals. water in 28 hours.	
200 Perkins -----			No water came into hole in 15 hours.	
200 Perkins -----			1 gal. water in 19 hours.	
200 Perkins -----			7' oil and water in 12 hours.	
200 Perkins -----			4 gals. water in 22½ hours.	
200 Perkins -----			5 gals. water in 13 hours.	
200 Perkins -----			2' of water in 15 hours.	
200 Perkins -----			10' of water in 12 hours.	
200 Perkins -----			5' of water in 19 hours.	
30 Dump bailer -----			Hole stood dry 18 hours.	
32 Dump bailer -----			Hole bailed to 50'; no change in 19 hours.	
40 Dump bailer -----			Hole bailed to 2,408'; 25' of water in 24 hours.	
200 Perkins -----				760' water in 21 hrs.
25 Pumped through rips.				320' water in 15 hrs.
31 Tubing, 1,000 lbs. pressure.			No water after 12 hours.	
80 Perkins -----			10' of water in 12 hours.	
150 Pumped through tubing.			2 qts. of water in 19 hours.	
150 Perkins -----			4' mud and water in 15½ hours.	
150 Pumped through tubing.			8 gals. water in 15 hours.	
150 Pumped through tubing.			½ gal. mud in 12 hours.	
150 Pumped through tubing.			5 gals. mud in 12½ hours.	
150 Pumped through tubing.			3 gals. water in 15½ hours.	
150 Perkins -----			Hole bailed to 1,800'; 27' of water in 12 hours.	
150 Perkins -----			12' sulphur water in 18 hours.	
150 Perkins -----			Hole bailed to 1,800'; 12' of water in 14 hours.	
150 Perkins -----			22' of water in 12 hours.	
150 Perkins -----			15' of water in 13 hours.	
150 Perkins -----			Hole bailed to 1,800'; 12' of water in 19½ hours.	
144 Perkins -----			Hole bailed to 2,000'; 20' water in 20 hours.	
150 Perkins -----			Hole bailed to 2,075'; no change in 13 hours.	
80 Perkins -----			Hole bailed to 2,000'; 10' of water in 20 hours.	
150 Perkins -----				Company reported shut-off failure.
25 Pumped through tubing.			2' of water in 15 hours.	
150 Perkins -----				Company reported shut-off failure.

TABLE V. DISTRICT

Field, section, township, range, or lease	Report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		
						Diam. (inches)	Weight (pounds)	Length (feet)
Coalinga—Continued.								
Sec. 34, T. 19 S., R. 15 E., M. D.	5-59	9/29/17	1,842	-----	Rotary	10	45	1,840
	5-54	9/21/17	1,746	-----	Rotary	10	45-48	1,745
	5-153	3/18/18	1,868	-----	Rotary	10	45	1,865
	5-166	4/ 8/18	1,798	-----	Rotary	10	45	1,796
	5-187	5/22/18	1,802	-----	Rotary	10	45	1,800
Sec. 35, T. 19 S., R. 15 E., M. D.	5-171	4/30/18	2,467	-----	Rotary	10	45-48	2,465
	5-38	8/18/17	3,407	-----	Cable	8 $\frac{1}{2}$	-----	3,402
	5-160	3/29/18	3,423	-----	Cable	8 $\frac{1}{2}$	-----	3,417
	5-157	3/22/18	3,273	Pumping test.	Cable	8 $\frac{1}{2}$	-----	3,131
	5-37	8/17/17	2,537	-----	Rotary	11	47	2,532
	5-32	8/13/17	2,356	-----	Rotary	11	47	2,345
	5-188	3/27/18	2,398	-----	Cable	8 $\frac{1}{2}$	-----	2,390
	5-74	10/31/17	2,271	-----	Rotary	11	60	2,262
	5-53	9/18/17	2,480	-----	Rotary	11	47	2,474
	5-161	3/29/18	2,596	-----	Cable	8 $\frac{1}{2}$	-----	2,596
	5-161	3/29/18	2,595	-----	Rotary	11	-----	2,550
	5-70	10/22/17	2,557	-----	Rotary	10	45	2,550
	5-71	10/29/17	2,463	-----	Rotary	10	45	2,451
	5-135	2/ 4/18	2,455	-----	Rotary	11	47	2,448
	5-170	4/18/18	2,529	-----	Rotary	10	-----	2,524
	5-175	5/ 7/18	2,536	-----	Cable	8 $\frac{1}{2}$ liner	36	2,535
	5-194	6/ 7/18	2,548	-----	Rotary	11	47	2,539
	5-204	6/25/18	2,556	-----	Cable	8 $\frac{1}{2}$ liner	36	2,552
Sec. 1, T. 20 S., R. 14 E., M. D.	5-173	6/ 3/18	2,624	-----	Rotary	11	-----	2,619
	5-56	9/24/17	309	-----	Cable	8 $\frac{1}{2}$	36	302
	5-93	10/26/17	320	-----	Cable	8 $\frac{1}{2}$	28	319
Sec. 12, T. 20 S., R. 14 E., M. D.	5-42	8/27/17	1,084	-----	Cable	10	40	1,081
	5-128	1/15/18	462	-----	Cable	10	40	451
	5-192	6/ 3/18	846	-----	Cable	10	40	841
Sec. 14, T. 20 S., R. 14 E., M. D.	5-59	9/11/17	732	-----	Cable	10	35-40	726
	5-85	11/16/17	-----	511	Cable	8 $\frac{1}{2}$ -7 $\frac{1}{2}$	-----	510
Sec. 24, T. 20 S., R. 14 E., M. D.	5-60	10/ 4/17	1,080	-----	Rotary	10	35	1,070
	5-91	11/22/17	1,150	1,126	Cable	6 $\frac{1}{2}$	-----	1,126
Sec. 1, T. 20 S., R. 15 E., M. D.	5-40	8/21/17	3,667	-----	Cable	8 $\frac{1}{2}$	43	3,662
	5-14	7/11/17	4,092	-----	Cable	8 $\frac{1}{2}$	43	3,848
	5-41	8/25/17	3,960	3,945	Cable	6 $\frac{1}{2}$	264	3,945
	5-23	7/27/17	3,747	3,734	Cable	8 $\frac{1}{2}$	43	3,734
	5-140	2/19/18	3,710	-----	Cable	8 $\frac{1}{2}$	43	3,708
Sec. 2, T. 20 S., R. 15 E., M. D.	5-169	4/15/18	3,682	-----	Cable	8 $\frac{1}{2}$	36	3,680
	5-20	7/18/17	3,534	-----	Cable	8 $\frac{1}{2}$	36	3,534
	5-168	4/11/18	3,402	-----	Cable	8 $\frac{1}{2}$	36	3,400
	5-201	6/18/18	3,363	-----	Cable	8 $\frac{1}{2}$	36	3,361
Sec. 6, T. 20 S., R. 15 E., M. D.	5-79	11/ 6/17	969	-----	Cable	10	40	967

## NUMBER FIVE—Continued.

Number sacks	Shut-off		Result	
	Cement	Formation shut-off	Success	Failure
Method				
200 Perkins	-----	-----	2 gals. water in 15 hours.	
200 Perkins	-----	-----	110' of fluid, no water, 19 hrs.	
200 Perkins	-----	-----	100' oil, no water, 30 hours.	
200 Perkins	-----	-----	1' water in 27 hours.	
200 Perkins	-----	-----	5' water in 14 hours.	
200 Perkins	-----	-----	3' of water in 13 hours.	
200 Perkins	-----	-----	Pumping test; trace of water at lead line.	
200 Perkins	-----	-----	1' of water in 17 hours.	
200 Perkins	-----	-----	4.4% water.	
200 Perkins	-----	-----	20' of water in 20 hours.	
200 Perkins	-----	-----	20' of water in 13 hours.	
30 Dump bailer	-----	-----	35' of water in bailer in 18 hrs.	
200 Perkins	-----	-----	35' of water in hole in 22 hours.	
200 Perkins	-----	-----	25' of water in 21 hours.	
50 Perkins	-----	-----	2' of water in 24 hours.	
200 Perkins	-----	-----		Company stated could not bail be- low 2,200'.
200 Perkins	-----	-----	No free water in 21½ hours.	
200 Perkins	-----	-----	¾ bailer of water in 19 hours.	
200 Perkins	-----	-----	1 gal. water in 27½ hours.	
160 Perkins	-----	-----		Water came in at rate of 130' per hr.
20 Dump bailer	-----	-----	Top of liner at 2,495'; no water in 13 hours.	
160 Perkins	-----	-----		Water came in 230' in 12 hours.
22 Dump bailer	-----	-----	5' of water in 14 hours.	
Perkins	-----	-----		Company reported shut-off failure.
160 Perkins	-----	-----		360' water in 20 hrs.
		Landed in shale.	Hole stood dry 12 hours.	
		Landed in blue clay.	½ gal. water in 17 hours.	
100 Perkins	-----	-----	Hole bailed to 810'; 2' rise in 19½ hours.	
20 Dump bailer	-----	-----	1 qt. mud in 12 hours.	
140 Perkins	-----	-----	No free water in 15½ hours.	
		-----	No water in 17 hours.	
		Landed in clay.	5' of water in 25 hours.	
166 Casing	-----	-----	10' of oil and water in 20 hrs.	
107 Tubing	-----	-----	Fluid came through bridge; 40' in 24 hours.	
160 Perkins	-----	-----	10' water in 24 hours.	
200 Perkins	-----	-----	Lead line sample showed a trace of water.	
60 Pumped through tubing.	-----	-----	Hole bailed to 3,441'; 78' drill- ing water returned.	
200 Perkins	-----	-----	Few gals. water in 17 hours.	
200 Perkins	-----	-----	Hole bailed to 2,590'; 18' of fluid, 20% water, 21 hours.	
125 Tubing	-----	-----	12' of water in 13½ hours.	
125 Tubing	-----	-----	10' of water in 14 hours.	
125 Tubing	-----	-----	Hole bailed to 3,000'; 15' of fluid in 13 hours.	
125 Tubing	-----	-----	Hole bailed to 2,510'; no water in 14½ hours.	
20 Dump bailer	-----	-----	1' of water in 18½ hours.	

TABLE V. DISTRICT

Field, section, township, range, or lease	"T" report		Depth of hole		Water string			
	Number	Date	Total drilled (feet)	Bridged to (feet)	Tools	Casing		
						Diam. (inches)	Weight (pounds)	Length (feet)
Coalinga—Continued.								
Sec. 7, T. 20 S., R. 15 E., M. D.	5-9	7/10/17	2,058	-----	Cable	8 $\frac{1}{4}$	32	2,050
	5-28	8/ 3/17	1,928	-----	Cable	8 $\frac{1}{4}$	-----	1,288
Sec. 8, T. 20 S., R. 15 E., M. D.	5-162	3/30/18	2,788	-----	Rotary	10	-----	2,777
	5-177	5/ 7/18	2,803	-----	Cable	8 $\frac{1}{4}$	-----	2,797
Sec. 12, T. 20 S., R. 15 E., M. D.	5-55	9/21/17	4,628	-----	Cable	6 $\frac{1}{4}$	28	4,613
	5-47	9/ 8/17	4,226	-----	Cable	6 $\frac{1}{4}$	28	4,214
	5-132	1/28/18	4,228	-----	Cable	6 $\frac{1}{4}$	26	4,215
	5-110	12/17/17	3,930	-----	Cable	8 $\frac{1}{4}$	36	3,919
Sec. 18, T. 20 S., R. 15 E., M. D.	5-205	6/29/18	2,535	-----	Cable	6 $\frac{1}{4}$	26	2,331
	5-180	5/13/18	2,292	-----	Cable	6 $\frac{1}{4}$	-----	2,290
Sec. 20, T. 20 S., R. 15 E., M. D.	5-141	-----	3,340	-----	Cable	6 $\frac{1}{4}$	-----	3,326

## NUMBER FIVE—Continued.

Shut-off		Result		
Cement		Formation shut-off	Success	Failure
Number sacks	Method			
50	-----	48' of drilling water in 12 hrs.		
58	Tubing -----	15' of mud and oil in 16½ hours.		
300	Perkins -----	-----		207' water in 17 hrs.
30	Tubing -----	14' of water in 17½ hours.		
120	Perkins -----	-----		1,266' water in 16½ hrs.
70	Perkins -----	Hole bailed to 3,200'; 20' of water in 19 hours.		
70	Perkins -----	Hole bailed to 3,198'; 9 gals. water in 13½ hours.		
60	Perkins -----	1 gal. water in 13 hours.		
150	Tubing -----	5 gals. water in 22½ hours.		
12	Dump bailer -----	15' of water in 24½ hours.		
40	Perkins -----	6' of water per hour.		

## PROGRESS CHART FOR COMPARISON OF A GROUP OF DRILLING WELLS.

By R. E. COLLOM, Chief Deputy.

During drilling operations at certain wells of a group it frequently happens that there are marked changes in producing conditions at neighboring wells. In order to compare the effect of drilling wells upon the other wells a chart showing drilling progress will be found more convenient than written records. The chart here presented differs from those ordinarily used in engineering work in that it directly refers to distances from known strata rather than the ground surface. It therefore directly compares geological information with drilling and production data.

Referring to the accompanying cross-section of a group of wells, (fig. 8) it will be noted that a line of correlation, "B," has been drawn across the top of the oil sands of the "second oil zone." This line defines the stratigraphy of the formations.

With the idea of presenting a graphic history of drilling operations with respect to the stratigraphy of the formations penetrated rather than the respective depths below surface, a line parallel to the line of correlation B (see cross section) is assumed at a position below which the essential depths drilled can be plotted. The distance between the line of correlation and stratigraphic datum can be chosen arbitrarily.

In certain localities where some definitely known stratum or formation marker exists—such as "Red rock," in the Coalinga East Side field, or "Bottom of blue shale," in the Casmalia field—the line of correlation of this stratum, in the various wells may be used as stratigraphic datum.

When such a stratum, as the one referred to, exists in a group of wells, one progress chart can be made for the entire group, irrespective of their location.

On the accompanying cross-section stratigraphic datum is drawn through zero depth, that is derrick floor at Well No. 6, so that all corrections for differences from surface to stratigraphic datum in each of the wells will be plus. In this position also the drilling records with respect to the principal upper water strata and other formations of importance can be plotted.

The data on the Progress Chart are shown with respect to time and depth. A convenient vertical scale is 100 feet to 1 inch. The depths drilled per day here shown would be unusual for anything but illustration. Progress in drilling is plotted from the daily tour records. It is not necessary, for plotting, to figure corrections between depths below surface and depths below stratigraphic datum. A graphic scale may

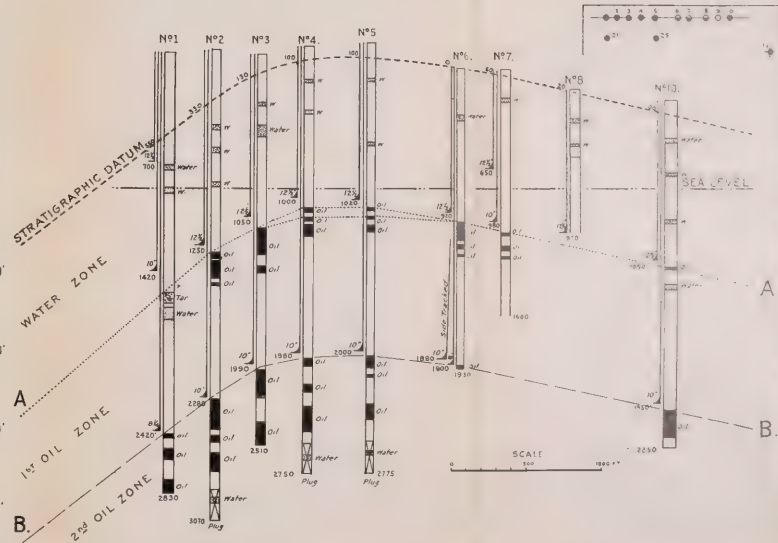
# STATIONARY

THE STATIONARY STATE

BY J. H. COOPER



## R·E·COLLOM



*Accompanying Bulletin No 84, California State Mining Bureau.*

merely be placed in such a position on the chart as to automatically correct for the distance of the derrick floor above or below the stratigraphic datum line.

At the left end of the progress chart is a composite graphic log of formations between stratigraphic datum and the bottom of the stratigraphically deepest well in the group.

All lines of correlation are horizontal on the Progress Chart. Drilling operations in any well, plotted as the work progresses can be referred across the chart to the composite log for a check on the formational progress of the work.

As formations logged in certain wells may not be logged, although present, in a well being drilled, the combination of conditions, such as water sands, caves, shells, etc., for all wells of a group, in a composite log is a useful guide, although it should not displace the ordinary cross-section for accurate work.

In preparing cross-sections, where the correlations are definitely known stratigraphic datum can be used as the base line, instead of sea level. As on the Progress Chart, this will make the lines of correlation horizontal and is a convenient method for comparison of relative depths, thickness of formations and other inter-related features.

The Progress Chart gives a graphic history of operations in all the wells of a group. For example, reading up the vertical line for August 1, 1917, on the attached Progress Chart, it is easy to tell how many wells in the group were completed or in the oil sand at that date, also what wells were drilling or standing cemented.

The Progress Chart could be used to advantage in the comparison of drilling records, either as to personnel of crews or methods of drilling. A comparison under this system would be more accurate, because of more nearly equal formational conditions, than a comparison by plotting to depths below surface.

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## CHAPTER III.

## LOS ANGELES AND ORANGE COUNTIES.

By M. J. KIRWAN, Deputy Supervisor.

**Names of Fields.**

Operations requiring the attention of this office include eight developed oil fields lying within the boundaries of Los Angeles and Orange Counties.

The name Whittier-Fullerton Oil fields follows common usage to include all fields east of the city of Los Angeles: namely Olinda, Brea Cañon, Whittier, Coyote Hills, Montebello and Puente.

In addition to the above the Salt Lake field located immediately west and the Newhall field about 30 miles northwest of the city of Los Angeles, are included in the district.

**Geology.**

The geology of the various fields in the district was covered briefly in Bulletins Nos. 73 and 82 and other publications of the State Mining Bureau.

However, additional geological data which has been obtained since these bulletins were published will be found under the divisions relating to the various fields in the following pages.

**General Statement.**

The entire production of oil in this district was produced by wells in Los Angeles and Orange counties.

The data used in the following tables relative to number of producing wells and their production were taken from production reports filed by the operators with the department.

The number of wells listed: number of producing wells: number of logs filed: number of graphic logs: average daily production of oil and water per producing well (for June 1918): percentage of water and number of acres of proved oil land, are shown by fields in Table 1. "Wells Listed" include new wells, wells drilled and abandoned wells.

TABLE 1.

Field	Wells listed	Logs filed	Graphic logs	Number of wells accounted for by production reports	Number of wells actually producing according to production reports	Average daily production		Average daily production per producing well		Percentage of water	Proved oil land acreage
						Barrels of oil	Barrels of water	Barrels of oil	Barrels of water		
Coyote Hills	271	236	228	192	186	39,669	2,428	213	13	5.7	2,021.75
Olinda	357	229	220	275	258	7,788	1,461	30	5.6	15	1,366.43
Brea Canon	90	77	76	68	64	4,243	1,830	66	28	30	280.16
Puente	88	3	2	44	44	54	5	1.2	.1	8.5	225
Whittier	274	224	204	159	148	2,755	2,344	18	16	46	526.30
Montebello	89	18	18	22	22	16,985	1,620	772	73.6	8.7	180.50
Salt Lake	411	389	384	282	267	2,949	1,998	11	7.4	40.4	1,016.3
Newhall	212	57	35	80	79	327	364	4.1	4.6	52.6	201.13
Miscellaneous	16	10	6								
Totals	1,808	1,243	1,173	1,122	1,068	74,770	12,070	70	11.3	13.8	5,817.57

The following table (Table 2) is a comparison of the number of wells actually producing; their average daily production of oil and of water; average daily production per producing well; and percentage of water, for all fields in the district during the month of June, for the last two fiscal years.

Study of the table shows that there was an increase of 91 producing wells, and an increase of 29,578 barrels in the average daily fluid production, of which 28,236 barrels were oil and 1342 barrels were water, for June, 1918 over June, 1917. The table also shows that the average daily production of oil per producing well rose from 47.6 barrels in June, 1917, to 70.0 barrels in June, 1918. The percentage of water of the total fluid production decreased from 18.8 per cent to 13.8 per cent during the same period.

Data similar to that in the foregoing tables are given under their respective fields in the following pages. It may be noted that there was little change in the number of producing wells and their production during the past year for all fields, except Coyote Hills and Montebello where there was a decided increase in the production of oil.

TABLE 2.

Month and year	Number of wells actually producing	Average daily production		Average daily production per producing well		Percentage of water
		Bbl. oil	Bbl. water	Bbl. oil	Bbl. water	
June, 1917 .....	977	46,534	10,728	47.6	11	18.8
June, 1918 .....	1,068	74,770	12,070	70	11.3	13.8

The following table (Table 3) shows a comparison of the average daily production of wells which were completed previous to July 1, 1917, for June, 1917 and June, 1918.

TABLE 3.

Month and year	Number of wells actually producing	Average daily production		Average daily production per producing well		Percentage of water
		Bbl. oil	Bbl. water	Bbl. oil	Bbl. water	
June, 1917 .....	977	46,534	10,728	47.6	11	18.8
June, 1918 .....	996	35,474	9,801	35.6	9.8	21.6

Study of table 3, shows that of the wells completed prior to July 1, 1917, there were 19 more wells producing in June, 1918, than June, 1917. This is accounted for mainly by wells which were shut down in June, 1917, and others which were undergoing repairs during this month, and which were producing in June, 1918. There are some cases where companies failed to properly report all wells producing until recently.

During the last fiscal year there was a decline of 11,987 barrels in the total average daily fluid production, of which 11,060 barrels were oil and 927 barrels were water. There was a decline of 13.2 barrels in the average daily production of fluid per producing well of which 12.0 barrels were oil and 1.2 barrels were water.

The following table (Table 4) shows by fields the number of wells completed during the last fiscal year; the number of these wells actually producing in June, 1918; their average daily production of oil and water; the average daily production of oil and water per producing well and the percentage of water for this month. This table shows that the greatest increase in production of oil was in the Coyote Hills field and the greatest increase in water was in the Montebello field.

TABLE 4.

Field	Number of wells		Average daily production		Average daily production per producing well		Percentage of water
	Completed during year	Actually producing	Barrels oil	Barrels water	Barrels oil	Barrels water	
Coyote Hills -----	29	28	21,494	405	767.6	14.5	1.9
Olinda -----	13	13	1,190	211	91.5	16.2	15.1
Brea Canon -----	1	1	39	.3	39	.3	.1
Puente -----							
Whittier -----	10	8	317	46	39.6	5.7	12.7
Montebello -----	20	20	16,255	1,605	812.8	80.2	9
Salt Lake -----							
Newhall -----	3	2	1.3	2	.7	1	60
Totals -----	76	72	39,296.3	2,269.3	545.8	31.5	5.5

In connection with Table 4 it will be interesting to note that one well in the Olinda field produced 46.8 per cent, one well in the Whittier field 67.0 per cent and one well in the Montebello field 60.5 per cent of all water shown in the Table for their respective fields. For information relative to the probable source of water entering these wells see summary of water conditions under their respective fields.

A comparison of the production of oil and water and percentage of water produced by wells in all fields completed previous to the last fiscal year, with wells completed during the last fiscal year is given for the month of June, 1918, in the following table: (Table 5)

TABLE 5.

Date wells completed	Number of wells actually producing	Average daily production		Average daily production per producing well		Percentage of water
		Bbl. oil	Bbl. water	Bbl. oil	Bbl. water	
Previous to last fiscal year	996	35,474	9,801	35.6	9.8	21.6
During last fiscal year -----	72	39,296	2,269	545.8	31.5	5.5
Totals, June, 1918 -----	1,068	74,770	12,070	70	11.3	13.8

The foregoing table shows that wells completed during the last fiscal year produced 52.6 per cent of the oil and 18.8 per cent of the water produced by all wells in the district during June, 1918. Further discussion of data in table 5 is given under summary of water conditions in the following pages.

A comparison may be made from the following table (Table 6) of written notices received and written decisions made during the last two fiscal years ending June 30 of each year. Three hundred and two more notices were received and 388 more decisions were made during the last year than the previous fiscal year, indicating the relative difference in amount of work handled in the office during the last two years.

TABLE 6.

Classification of notice or decisions	Year 1916-1917		Year 1917-1918	
	Notices	Decisions	Notices	Decisions
Relating to drilling of new wells.....	90	86	260	273
Relating to deepening or redrilling of wells.....	35	38	70	75
Relating to abandonment of wells.....	33	33	39	37
Test of water shut-off.....	108	96	199	256
Totals.....	266	253	568	641

Table 7 shows by fields the number of wells completed during the last fiscal year, the number of wells producing June, 1917, the number of wells producing June, 1918, and the net gain in the number of producing wells.

TABLE 7.

Field	Wells completed during fiscal year; producing 1918	Producing June, 1917	Producing June, 1918	Net gain in producing wells, June, 1918
Coyote Hills .....	28	161	186	25
Olinda .....	13	251	258	7
Brea Canon .....	1	62	64	2
Puente .....		44	44	
Whittier .....	8	139	148	9
Montebello .....	20	2	22	20
Salt Lake .....		243	267	24
Newhall .....	2	75	79	4
Miscellaneous .....				
Totals.....	72	977	1,068	91

It will be noted that the Salt Lake field shows a net gain of 24 producing wells for June, 1918, over June, 1917, though no new wells were completed in this field. This is accounted for by the fact, that certain wells which were idle in June, 1917 have since been placed upon the producing list and, in a few cases, a failure to properly report wells in the former year.

The following table (Table 8 shows a comparison, by fields, for the month of June, 1917, and June, 1918, of the relative amount of water produced by individual wells. The wells have been divided into three classes as follows: 0-20 barrels; 20-40 barrels and 40 or more, barrels of water per producing day.

TABLE 8.

Field	Number of wells producing 0-20 barrels water		Number of wells producing 20-40 barrels water		Number of wells producing 40 barrels, or more, water		Total number of wells	
	1916-1917	1917-1918	1916-1917	1917-1918	1916-1917	1917-1918	1916-1917	1917-1918
Coyote Hills -----	134	154	10	12	17	20	161	186
Olinda -----	237	239	8	13	6	6	251	258
Brea Canon -----	47	49	3	4	12	11	62	61
Puente -----	44	44					44	41
Whittier -----	116	123	7	9	16	16	139	148
Montebello -----	2	14				8	2	22
Salt Lake -----	210	236	13	11	20	20	243	267
Newhall -----	72	74	2	3	1	2	75	79
Totals -----	862	933	43	52	72	83	977	1,068

The data in Table 8 was taken from maps prepared by the department of the various fields showing by symbols the relative amount of water produced daily by individual wells during the month of June for both 1917 and 1918. Separate maps of the different fields were prepared for each year. On these maps all producing wells are shown in triangles, squares and circles. Triangles colored yellow were used for wells producing 0-20 barrels of water. Squares colored blue for wells producing 20-40 barrels of water and circles colored red for wells producing 40 barrels and over, per producing day. The use of the different colors, particularly the red, gives prominence to the different well classifications and readily show the areas affected by water.

The following table shows total number of barrels of oil and water and percentage of water produced during the fiscal year by fields, (1) by wells completed prior to July 1, 1917, (2) by wells completed during the fiscal year, and (3) by all wells in the district.

TABLE 9.

Field	Total oil and water produced by wells completed prior to July 1, 1917			Total oil and water produced by wells completed during fiscal year			Total oil and water produced by all wells during fiscal year		
	Bbl. oil	Bbl. water	Per cent water	Bbl. oil	Bbl. water	Per cent water	Bbl. oil	Bbl. water	Per cent water
Coyote Hills -----	7,565,004	822,333	9.8	4,178,948	72,201	1.7	11,743,952	894,534	7.1
Olinda -----	2,703,103	393,850	12.7	206,318	39,049	15.9	2,909,421	432,899	12.9
Brea Canon -----	1,614,068	661,755	29	1,172	24	2	1,615,240	661,779	29
Puente -----	19,415	1,838	8.6				19,415	1,838	8.6
Whittier -----	1,016,740	912,188	48.1	85,713	71,492	45.5	1,102,453	1,013,680	48
Montebello -----	312,209	3,583	1.1	2,951,180	210,700	6.6	3,263,389	214,283	6.1
Salt Lake -----	1,134,797	764,975	40.3				1,134,797	764,975	40.2
Newhall -----	118,464	130,662	52.6	825	1,994	70.7	119,289	132,656	52.7
Totals -----	14,483,800	3,721,184	20.5	7,424,156	395,460	5.1	21,907,956	4,116,644	15.8

### Summary of Water Conditions.

Study of Table 9 shows that the total fluid produced during the fiscal year by wells completed prior to July 1, 1917, was 18,204,984 barrels, of which 14,483,800 barrels were oil and 3,721,184 barrels were water, a water percentage of 20.5 per cent. Fluid produced during the fiscal year by wells completed during said year totaled 7,819,616 barrels, of which 7,424,156 barrels were oil and 395,460 barrels were water, or a water percentage of 5.1 per cent.

The total fluid produced by all wells during the fiscal year was 26,024,600 barrels, of which 21,907,956 barrels were oil and 4,116,644 barrels were water—or 15.8 per cent water.

A further study of the table shows that all fields with the exception of Olinda, Montebello and Newhall showed a decrease in the percentage of water produced by the wells completed during the fiscal year compared to wells completed prior to that date. The production figures are taken up in more detail under the respective fields in the following pages. However, it may be well to note briefly at this point the fields in which the percentage of water of the new wells is greater than that of the wells drilled prior to July 1, 1917. Three wells out of a total of 13 wells completed in the Olinda field during the fiscal year produced 76.7 per cent of all water produced by the new wells, during said year. One was probably drilled into water below the oil bearing formations, as the company is at present engaged in plugging the lower portion of the well. The other two are located near an old well, which was drilled into water bearing formations below the upper oil sands and was improperly plugged. The owners having decided that the water in the new wells is due to this condition are replugging the old well. One well in the Montebello field produced 70.3 per cent of all water produced by 20 new wells completed in this field during the past fiscal year. The source of this water, as pointed out under the discussion of the Montebello field, is probably an intermediate water between the upper and lower oil zones.

In the Newhall field one well out of a total of 3 completed produced in one month 66.8 per cent of the total amount of water produced by the new wells during the entire fiscal year. This well has been plugged and abandoned.

In the Whittier field, although the table shows that the percentage of water in the wells completed during the fiscal year, is less than that shown by wells completed prior to July 1, 1917, a great improvement has been noted since repair work has been started on one well in the field which previously had produced 65.7 per cent of all the water produced by new wells in this field during the last fiscal year. After taking this well from the producing list, the remaining new wells averaged 12.7 per cent water in their production in comparison with 45.5

per cent water when this well was producing. The six wells mentioned above in a total of 76 completed during the fiscal year, produced 229,410 barrels of water out of a total of 395,460 barrels, or 58 per cent of the total water produced by all new wells completed during the fiscal year. With the exception of the well in the Montebello field, repair work has been started in order to eliminate the water troubles in these wells.

The following paragraphs contain a comparison of water conditions in June, 1917, with water conditions in June, 1918.

There was an increase of 28,236 barrels of oil and an increase of 1,342 barrels of water for the entire district during June, 1918, as against the same month in 1917. Wells completed during the fiscal year averaged 5.5 per cent water in their total fluid production for June, 1918, while wells completed previous to the fiscal year averaged 21.6 per cent water in their total fluid production for the same month. The number of barrels of water per producing well per day remained practically the same, namely 11, for June, 1917, and 11.3 for June, 1918. The decrease in the percentage of water of the total fluid produced in the district from 18.8 per cent in June, 1917, to 13.8 per cent in June, 1918, is accounted for mainly by the large increase of practically clean oil by new wells in the Coyote Hills field. One well in the Montebello field, while it averaged over 3200 barrels of oil per day, produced 990 barrels of water per day, accounting for 43.6 per cent of the water produced in June by all wells in the district completed during the fiscal year.

The Montebello field furnished 20 out of the 72 new wells completed during the year and producing in June, 1918. These wells averaged 1605 barrels of water per day during this month, or about 71 per cent of all water produced in this district by wells completed during this year. These wells averaged 80.2 barrels of water each per day and 9.0 per cent of their total fluid production was water. Aside from the Montebello field, other wells completed in the district during the fiscal year made a daily average of 12.8 barrels of water per well per day during June, 1918, and 2.9 per cent of the total fluid production during this month was water.

There was a decrease of 927 barrels or 8.6 per cent in water, produced daily by wells completed prior to the last fiscal year in June, 1918, as against the same month in 1917. This decrease is accounted for largely by a number of wells which were plugged and abandoned or not pumped on account of the small production of oil, and large production of water.

In general companies in this district make an earnest effort to determine closely the amount of water produced by each of their wells.

There are, however, a few companies who do not make an appreciable effort to determine the amount of water produced by their wells and in some cases report wells as making little or no water when it is known that they make considerable water. Members of the department have visited many properties for the purpose of giving assistance as to the proper method of making out production reports. Some companies with wells whose production is fairly constant and which produce small amounts of oil and water are required to file reports only once every three months.

In all cases where full approval of the department was given as to depth and test of water shut-off, it was necessary in only one case to redrill a well to shut off "top" water.

In the case mentioned it is probable the trouble resulted from water below, rather than from above the oil formations which were penetrated. In view of the test or tests witnessed, by the department, at each new well, it is probable that the greater number, or nearly all such wells produce what water they make from sources below the shut-off point. Frequently wells are drilled too deep so as to penetrate water-bearing formation below the oil measures from which it is desired to produce and have to be plugged near the bottom.

Among the most difficult problems presented to the department is the supervision of wells penetrating water-bearing strata between oil-bearing formations, for the purpose of producing from below the water. Such water is generally known as "intermediate" water. Certain phases of this problem are dealt with elsewhere in this report.

#### **Graphic Logs, Peg Models and Cross Sections.**

A total of 1173 graphic logs have been drawn, or an increase of 296 graphic logs over last year. Nearly all of these logs were drawn in the San Francisco office of the department. During the last year "memorandum" or advance copies of logs were received from nearly every company drilling new wells. Graphic logs of these wells were kept up to date by the local office, as the information was received, and were of much assistance in rendering decisions relative to proposed shut-off depths in new wells; a total of 80 graphic logs are being so drawn.

At the end of the fiscal year peg models had been constructed covering 10,880 acres or 17 square miles. This is an increase of 9,200 acres over similar previous construction. Models have now been constructed covering practically all of each field except Brea Cañon, Salt Lake and Newhall. Models of these fields will be constructed as rapidly as possible. All of the models have been constructed to a scale of 100' to 1" and the more important portions of them set up in a special room 18' by 30'. The models are kept up to date showing both the com-

pleted and drilling wells. The construction of peg models has recently been begun by the Petroleum Development, Union Oil, Petroleum Midway and Red Star Petroleum companies, covering certain portions of their properties in this district. Some of the other large companies, probably, will begin the construction of models in the near future. A number of companies, both large and small, use the models made by the department to secure estimates of depth at which water should be shut off in proposed wells and in some cases the depth to which wells may be safely drilled so as to penetrate as much oil formation as possible without encountering water below.

A brief description of the value of a peg model and the method of constructing models which have been erected in the various field offices of this department is given on pages 64 and 65 of Bulletin No. 82, Second Annual Report of the State Oil and Gas Supervisor.

### **Cross Sections.**

A number of cross sections have been drawn for use in supplementing data furnished by peg models. In nearly every case the cross sections were made by pasting graphic logs, in their true position, as to elevation and location, on tracing cloth and blue prints made. Further data as to methods employed to study underground conditions is given under the discussion of the various fields in the following pages.

### **Method of Operations.**

In general, operators in this district have displayed a willingness to co-operate with the department to obtain accurate information relative to their wells. The department desires to see an improvement in the system employed by some companies in securing and compiling information relative to the production of their wells. This information is of vital importance to the companies involved as well as to this department, as it furnishes the basis by which it can be determined whether a well is being profitably produced.

In a few cases it has been necessary to call to the attention of a company, inaccuracies in measurement of casing and depth of wells. As an example of this, a well in the Coyote Hills field, by the use of an incorrect sand line measurement, was reported to be 3646' deep with 8 $\frac{1}{4}$ " casing cemented at a depth of 3626'. At the time the test of water shut-off was witnessed by this department, it was found that the casing was actually cemented at a depth of 3649' instead of 3626' as reported, thus necessitating a change of 23' which had to be apportioned in the log of the well. This error was caused by using a sand line measurement of 232' 6" in measuring the depth of the well, while the true measurement when measured by a representative of this department with a steel tape was found to be 234', thus introducing an

accumulative error of 1' 6" every time the derrick was "strung over." It is evident that a careful record of the casing put into this well was not kept, or the discrepancy of the measurement of the depth at which the casing was cemented would have been found.

In the course of testing wells many interesting features have been observed. In several cases it was found that water was entering a well and the operator claimed the water was encountered in formations below the shoe of the water string. Subsequent tests demonstrated that the water was coming from above the shoe of water string. In some instances large quantities of cement were forced back of the casing and in one case in the Montebello field circulation to the surface back of the water string was established. In one instance in the Olinda field, the owner of a well which was tested by this department claimed that oil-bearing formations which had been penetrated below the shoe of the water string carried a certain amount of water, thus accounting for the water present in the well at the time of the test. To substantiate his claim he cited the production of a neighboring well, the water content of which equalled the amount of water present in the well being tested. Upon recommendation of this department, a cement plug was placed below and extended up into the water string. Subsequent tests showed the same amount of water entering the well, conclusively demonstrating that the water present in the well at the various tests was due to a casing leak. This trouble might have been avoided and the company saved considerable time and expense had a casing test been made previous to drilling out the cement plug before test of water shut-off. It is the practice of some operators in this district to make casing tests on all wells previous to drilling out the cement plug in the bottom of the casing and the department desires to commend such practice, as results obtained at such tests have revealed the existence of a number of casing leaks.

The use of the rotary method of drilling is becoming more prevalent, especially in the newer fields in the district. In the Montebello field it is the general practice, with a few exceptions, to drill into the oil-bearing formations with rotary tools, allow the bottom of the hole to fill up when underreamed with reamings and cement the water string upon the plug formed by these reamings. The well is then usually "drilled in" with standard tools, though in some cases the rotary system is used throughout the drilling of the well.

In the western portion of the Coyote Hills field the usual practice is to set a string of 10" casing at an average depth of about 2950' with rotary tools. The well is then drilled ahead with standard tools and the 8 $\frac{1}{4}$ " casing cemented as a water string after which the well is usually completed with the rotary system. The companies operating in the eastern portion of the Coyote Hills field, as a general rule, set

the water string with the rotary system and drill the well into the oil-bearing formations with cable tools.

In the Olinda field, the rotary system was recently tried but the companies using the system decided that it was not adapted to drilling in the area in which it was tried and resumed the use of standard tools. The latter system is in general use throughout the field at present.

In the Brea Cañon field the rotary system has been tried and a few wells are being drilled with rotary tools, but the majority of the wells sunk in this field use standard tools.

In the Whittier field the use of standard tools is almost universal, as is also the case in the Puente and Newhall fields.

There were no new wells drilled in the Salt Lake field during the past fiscal year.

The number of casing leaks found in this district during the last year was greater, per well tested for water shut-off, than in former years. This is probably accounted for by more casing tests having been made and the quality of the casing used not being up to the previous standard. Most of the casing leaks were eliminated by perforating the water string a short distance above the shoe of the next outside casing and forcing cement through the perforation, cementing the two strings of casings together so as to prevent the passage of water up between them. A casing leak found in the water string of one well in the Coyote Hills field, 585' above the shoe of the next outside casing, was repaired by perforating the water string 103' below the shoe of the outside casing and forcing cement through the perforation. The cement evidently passed up back of the water string and between it and the next casing, as vibration was found in the water string 400' above the shoe of the next outside casing. The perforation in this case was about 100' above the shoe of the water string.

There were several cases where bailing tests extending over a period of several days exhausted the water entering a well through a leak in the water string. In these cases it is probable that water standing back of the water string drained out down to the point of the leak and that no additional water was passing back of the water string and the next outside casing.

One well in the Whittier field showed an increase of over 100' of water per day when the casing was first tested and gradually exhausted after bailing for about a week. In this case the fluid was all bailed out each day down to the top of the cement plug in the bottom of the water string.

#### **Legal Action.**

It was necessary to resort to legal action because of the manner of drilling Baldwin Well No. 4, of the Red Star Petroleum Company, Sec. 6, T. 2 S., R. 11 W., S. B. B. & M.

In the Notice of Intention to commence drilling this well, the company proposed to shut off water at a depth of 1800', and estimated that oil-bearing formation should be encountered at this depth. In reply to this notice the department recommended that the company shut off water above the first oil-bearing formation encountered in the well, and recommended that the company secure samples of formation every 10' in drilling, beginning at a depth of 1450', and that said samples be tested with chloroform or ether to determine whether or not they were oil bearing.

When a depth of 1511' had been reached in drilling the Deputy Supervisor visited the well and found that no samples had been taken. Upon returning to the well at a later date the Deputy Supervisor secured sample of formation, which was taken from the rotary bit at a depth of 1512', and upon testing the sample with chloroform found that it carried crude oil. The superintendent of the property was advised relative to this and he finally agreed to discontinue drilling and cement 12½" casing at a depth of 1475'. This agreement was entered into with the distinct understanding that oil-bearing formation had not been encountered above a depth of 1475'.

The 12½" casing was cemented at a depth of 1475', as agreed upon, on June 29, 1918. Following the date of cementing, evidence was furnished this department, and to the District Attorney on July 2, 1918, by the three drillers<sup>1</sup> that worked on this well, that oil-bearing formations had been encountered at a depth of 1395', or 80' above the point at which the well was cemented.

The matter of drilling this well was taken up by the department with the District Attorney's office and a complaint against the agent and general manager of the company was sworn to on July 5, 1918. This complaint read in part as follows:

"did then and there to wit, on the 26th day of June 1918, wilfully and unlawfully hinder and delay the enforcement of the law in that the evidence of encountering oil-bearing formations was deliberately concealed by wilfully rendering a false and fraudulent report, dated June 26, 1918, which failed to show, and did not show, the presence of oil-bearing formations, as having been encountered in said well, or the depth thereof, or character of the same, whereas, in truth and in fact, such oil-bearing formations had theretofore; to wit, on or about the 24th day of June, 1918, been encountered in said well."

The report mentioned in the complaint was a signed copy purporting to be the log of this well, giving record of formations encountered down to a depth of 1512'.

During the trial, which was held in the Justices' Court of Los Angeles County, the three drillers, who had drilled this well to a depth

<sup>1</sup>See pages 59 to 72, *ante*.

of 1512', testified that first oil-bearing formation was encountered in this well at a depth of 1395', or 80' above the depth at which the 12½" casing was cemented. Each of these three drillers testified that he had received instructions on other wells which he had worked on, under the same management, not to report any oil or gas showings on the log of the well, and not having had a change of instructions, he pursued the same policy in making out the log of the well under consideration. One of these drillers testified, during the trial, that acting under direct instructions from the foreman that a five-gallon can was used to remove the evidence of crude oil from the rotary ditch, previous to the arrival of the representative of this department.

The Red Star Petroleum Company filed with this department a copy of an analysis made, by R. O. Wrana, chemist, of sandy shale secured from a depth of 1512'. This analysis stated that "notwithstanding the comparatively large amount of oil extracted it does not originate in the shale. The absence of asphalt and its red color clearly demonstrate this. It is evidently drippings from the tools."

Copy of analysis made by Smith-Emery Company, chemist, furnished the department on June 26, 1918, gives the following data:

"Oil, per gram (reduced to decimal part of one)----- .00285  
Color of oil -----dark brown."

It developed during the trial that a supplementary or corrected copy of analysis was received by the Red Star Petroleum Company from Smith-Emery Company, chemists, on July 2, 1918, in which it was stated that the oil contained in the shale was *crude oil*. The latter information reached the department in the form of testimony by one of the witnesses for the defendant.

Study of the complaint, a portion of which was quoted above, shows that the company was not charged with failure to report oil at a depth of 1512', as it was agreed between the Deputy Supervisor and superintendent that casing should be cemented, and was actually cemented, at a depth of 1475'. The complaint does, however, specifically charge the company with having filed a log which failed to show that oil-bearing formations were encountered above a depth of 1475'. (Said log also failed to show that oil-bearing formation was encountered below a depth of 1475'.) The approval of the department given to the company to cement the 12½" casing, at a depth of 1475', would not have been given had it been known that such procedure would actually shut off 80' of oil-bearing formation. It should be noted that chemical analyses were made of formation from this well *after* the presence of crude oil had been noted by the Deputy Supervisor.

After hearing evidence for about four days the court dismissed the case. The greater portion of the evidence introduced by the defendant related to other wells which are located in various fields of the state.

There were 23 barrels of oil in the well when test of water shut-off was witnessed by a member of this department, when the hole was open to 1482' or 7' below the shoe of the 12½" casing. Following the test of water shut-off, the well was deepened and tested in stages, down to a depth of 1800'. The tests showed that no water-bearing formations were penetrated from the shut-off point (1470') to a depth of 1800' and that practically all formations penetrated between these depths carried oil. There were, therefore, several hundred feet of oil-bearing formations, which did not carry water, above the depth at which the company originally proposed to shut off water. However, the company excluded these behind 10" casing cemented at a depth of 1745', and deepened the well.

### Notices and Decisions.

The following table gives a summary by fields of written original and supplementary notices received and decisions made in this district during the fiscal year.

TABLE 10.

District No. 1— Fields	New wells				Tests		Deepen or redrill				Abandon			
	Original		Supp.		Notices.	Decisions.	Original		Supp.		Original		Supp.	
	Notices	Decisions	Notices	Decisions			Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
Coyote Hills..	19	21	34	44	51	100	14	14	3	6	13	14	6	4
Olinda .....	17	17	8	14	18	16	4	5	1	1	1	1	1	1
Brea Canon ..	1	1	2	2	3	4	2	1	2	2	2	1		
Puente .....	1	1	1	1	3	3					1	1		
Whittier .....	15	16	10	10	31	35	8	13	8	8	1	1		1
Montebello ..	73	72	62	57	79	81	1	1			1	1		
Salt Lake .....					3	3	4	5	2	1		1	2	2
Newhall .....	9	9	4	4	11	10	16	16	3	2	4	3	1	1
Miscellaneous.	3	2	1	2		4					5	4	1	1
Totals.....	138	139	122	134	199	256	51	55	19	20	28	27	11	10

Supplementary notices were filed by operators where new or changed conditions made it necessary to supplement the original notice. The decisions listed as "Supplementary" in Table 10 were made after receipt of supplementary notices and in most cases related to mechanical operations such as shooting and plugging and cementing of casing after failure to shut off water in the first attempt. Study of this table shows the relative amount of activity in the various fields of the district.

## LIST OF COMPLAINTS.

There were only two complaints received during the fiscal year which required a detailed investigation by the department.

*John C. Tuffree et al.*

vs.

*Fullerton Great West Oil Company.*

On March 22, 1917, verbal complaint was entered against Fullerton Great West Oil Company well No. 3, Section 19, T. 3 S., R. 9 W., S. B. B. & M., by Mr. John C. Tuffree, representing the ownership of the land on which this well was located, stating that the well had been pumping water for several months and requesting the department to make an investigation concerning the condition of the well. Upon receipt of this complaint the matter was taken up with the company, which in reply proposed to redrill the well. The department called the attention of the company to the fact that casing had been cemented several hundred feet below the productive oil measures in adjoining wells Nos. 1 and 2 on the property, and suggested that the company take this fact into account when filing their proposed notice of intention to redrill.

The Fullerton Great West Oil Company placed a shot in the lower portion of the well and put in a 10' cement plug. Following this work, the well was pumped for several months, when it was found that the shooting and plugging had not greatly improved the condition of the well. The matter of repair work was again taken up with the company by the department after several extensions of time had been given the company. A notice of intention to abandon the well was then filed, and upon receipt of this notice the department furnished the company with a detailed list of specifications covering shooting and plugging work necessary to protect all productive oil-bearing formations penetrated in the well. The work of abandonment was carried out by the company in accordance with the specifications issued, and final approval of the work was given the company by the department.

*Brea Cañon Oil Company*

vs.

*Union Oil Company.*

The attention of the department was called, on March 2, 1918, by the superintendent of the Brea Cañon Oil Company to the water condition of Union Oil Company "Stearns" well No. 53, Section 1, T. 3 S., R. 10 W., S. B. B. & M., Brea Cañon field. The Union Oil Company "Stearns" well referred to is located near the west line of their property in Section 1, adjoining the property of the Brea Cañon Oil Company.

The Brea Cañon Oil Company stated that they were drilling well No. 29, located near the Union Oil Company "Stearns" well No. 53, and that they expected to complete their well in a few months and that it may be affected by water from the Union "Stearns" well No. 53.

Records filed by the Union Oil Company showed that their "Stearns" well No. 53 was completed in July, 1912, and that the initial production of this well was 3000 barrels of fluid per day, which cut about 0.5% water. Production reports filed by the company show that the amount of water produced by this well has been fairly constant during the last year, and that the production of oil decreased about 50 barrels per day. At the time the complaint was entered, the well made about 125 barrels of oil and about 130 barrels of water per day.

The matter of the complaint was taken up by the department with the Union Oil Company, and in reply they state that no work had been done on the well for the past several years that, in their opinion, would be responsible for any increase in its water production and that they attributed the increase in water in the well to the work being done by the Brea Cañon Oil Company near their property. The Union Oil Company requested information relative to the condition of a well drilled near their "Stearns" well No. 53 which possibly was the source of the water entering the latter well.

In view of the fact that Brea Cañon Oil Company well No. 29 has not been completed, the department allowed the matter to rest pending developments in the latter well.

## ORDER NO. 6.

## CALIFORNIA STATE MINING BUREAU

## DEPARTMENT OF PETROLEUM AND GAS.

## Report on Test of Water Shut-off.

No. T 1 222.

Los Angeles, Cal. May 29, 1918.

Mr. J. W. Fuqua,

Los Angeles, Cal.,

Agent for Petroleum Midway Company, Ltd.

DEAR SIR:

Your well No. 1, Darlington, Section 31, T 1 S., R. 11 W., S. B. B. & M., Montebello Oil Field, in Los Angeles County, was this day tested for shut-off of water. Mr. C. C. Thoms, designated by the supervisor, was present as prescribed in Section 19, Chapter 718, Statutes 1915, and there were also present H. A. Davis, Superintendent; J. B. Case, Inspector; R. L. Peeler, Geologist; W. H. McHenry, driller; G. W. Husted, tool dresser. Location of water tested, top. Depth and manner of water shut-off, 10" casing, reported cemented at 2308', with 15 tons of cement, by Huber & Wilson process. Casing record of well, 12½" cemented at 2224', collapsed at 1564'. Reported total depth of hole, 2312' 6". Bailer went to 2310' 9" and brought up tablespoonful of material which may have been formation. Water bailed out to 2312' 6" at 2.30 p.m., May 28, 1918. At 3 p.m., May 29, 1918, bailer run to 2310' 9". Result of bailing test, about 10 gallons of fluid of which about one quart was oil, balance water. Bailer at successive increasing depths, beginning at 2227' to 2300', showing no fluid above a depth of 2300'. The bailer was then run to 2310' 9", and brought up about 10 gallons of fluid as noted above.

Following is copy of log record of this well, dated May 10, 1918, giving a record of certain formations penetrated:

"Reports, dated March 16 and March 20, read:

Top of formation.	Bottom of formation.	
2,175	2,269	Hard sandy shale.
2,209	2,275	Sandy shale.

Reports, as above, should read:

2,224	2,227	Hard sandy shale.
2,227	2,235	Sandy shale showing trace oil and gas.
22-35	22-40	Brown sandy shale, small showing oil and gas.
2,240	2,245	Brown shale and coarse sand.
2,245	2,289	Brown sandy shale showing oil and gas."

Following is similar copy of log record dated May 15, 1918:

Top of formation.	Bottom of formation.	
2,289	2,310	Brown shale showing oil and gas.
2,310	2,315	Hard brown shale.
2,315	2,316	Sticky blue shale.

May 13, depth 2,316 feet, stands cemented at 2,303 feet."

Both of these log records were received from the Petroleum Midway Company, Ltd.

On account of the fact that certain oil-bearing formations penetrated in this well above a depth of 2308', as shown by log record given above, have been shut off, it is hereby ordered that the Petroleum Midway Company, Ltd., do such work and conduct such tests as may be necessary to demonstrate to the satisfaction of the Supervisor that said oil-bearing formations are properly protected from water. Such tests shall be conducted June 10, 1918. This department will have a representative present at the well to witness said test. The date of test may, upon application of the owner, be changed from time to time in the discretion of the Supervisor.

R. P. McLAUGHLIN.  
State Oil and Gas Supervisor.  
By M. J. KIRWAN, Deputy.

This order was appealed to the District Oil and Gas Commissioners, who ordered further tests to determine if water was prevented from passing around shoe of 10" casing to lower levels in the well. They ordered that no tests, as in the premises of the supervisor's order, were necessary.

### COYOTE HILLS FIELD.

This field produced more than one-half of the oil produced in District No. 1 during the month of June, 1918. The field now contains 2022 acres of proved oil land, an increase of 154 acres during the last year.

Table 1 shows that there were 186 wells producing in June, 1918. These wells made a total daily average of 39,669 barrels of oil and 2428 barrels of water for this month, or a daily average of 213 barrels of oil and 13 barrels of water per producing well per day. The average daily production of oil increased about 50 per cent over the production of June, 1917, during the last year, while daily average production of water decreased about 8 per cent. Figures compiled by the department show that there was an increase in the average daily production of oil amounting to 13,384 barrels and a decrease of water amounting to 203

barrels during June, 1918, as against June, 1917. Twenty-nine wells were completed during the fiscal year, and 28 of these wells produced in June, 1918, and made a total daily average of 21,494 barrels of oil and 405 barrels of water during this month.

This is an average of 768 barrels of oil and 14.5 barrels of water per producing well per day, which is an average percentage of 1.9 per cent water. Wells completed prior to the last fiscal year averaged 18,175 barrels of oil and 2023 barrels of water per day during June, 1918. This is a decline in their daily production of 8110 barrels of oil and 608 barrels of water as against their daily production in June, 1917.

Wells completed prior to July 1, 1917, made a total fluid production of 8,387,337 barrels during the last fiscal year. Of this amount 7,565,004 barrels were oil and 822,333 barrels were water, or 9.8 per cent water. Wells completed during the last fiscal year made a total fluid production during this year of 4,251,149 barrels. Of this amount 4,178,949 barrels were oil and 72,201 barrels were water, or 1.7 per cent water. During the last fiscal year all wells in this field made a total fluid production of 11,743,952 barrels of oil and 894,534 barrels of water, or 7.1 per cent water. Table 8 shows that, during June, 1918, there were 186 wells producing. Of this number 154 wells produced from 0-20 barrels of water per day, 12 wells produced from 20 to 40 barrels of water per day, and 20 wells produced 40 barrels or more water per day. This is an increase of 20 wells producing 0-20 barrels of water, 2 wells producing 20-40 barrels of water, and 3 wells producing 40 or more barrels of water per day for June, 1918, as against the same month in 1917. The location of wells making 40 barrels or more water per day is as follows: One well near the north line of the N. W.  $\frac{1}{4}$  of Sec. 20, one well near the center of the N. E.  $\frac{1}{4}$  of Sec. 19, four wells in the S. E.  $\frac{1}{4}$  of Sec. 13, and one well in the W.  $\frac{1}{2}$  of the N. W.  $\frac{1}{4}$  of Sec. 24, all in T. 3 S., R. 9 W., S. B. B. & M. Wells making similar amounts of water in T. 3 S., R. 10 W., S. B. B. & M. are located as follows: Two wells in the S.  $\frac{1}{2}$  of the N. E.  $\frac{1}{4}$  of Sec. 22, one well in the N. E. corner of the N. W.  $\frac{1}{4}$  of Sec. 21, one well in the S. E.  $\frac{1}{4}$  of Sec. 17, two wells along the north line of the N. W.  $\frac{1}{4}$  of Sec. 19, and one well along the south line of the S. E.  $\frac{1}{4}$  of Sec. 18. The following wells located in T. 3 S., R. 11 W., S. B. B. & M., are also producing 40 barrels or more water per day: Four wells in the N. E.  $\frac{1}{4}$  of Sec. 24 and two wells in the S. E.  $\frac{1}{4}$  of Sec. 13.

From the foregoing it will be noted that wells producing 40 barrels or more of water per day are fairly well distributed throughout the field, and, with a few exceptions, the water trouble in them is probably local, due to the physical condition of the wells themselves, rather than the result of a widespread water-saturated area or encroaching edge water.

An interesting and profitable development in this field occurred at Standard Oil Company M/C well No. 44, Sec. 18, T. 3 S., R. 10 W., S. B. B. & M., in which 10" casing was cemented above an upper oil zone shut off by all other wells on the property. The well is located near the apex of the anticline and therefore in a favorable location in which to make a test of upper oil formations, which at this location is about 250' above the oil-bearing formations produced from by all other wells on the property. The upper oil zone was tested upon recommendation of the department. In accordance with our recommendation, the well was drilled 30' below the shut-off point, and when tested for production, according to production reports, averaged 290 barrels of oil and 0.1 barrel of water per day for the first 25 days. Following the test the company proposed to deepen. Water was evidently encountered in deepening as the lower portion of the well was plugged, after which it averaged about 80 barrels of oil and 70 barrels of water per day. In deepening, the well was drilled to within 100' of the point where the company proposed to shut off water above the zone from which all other wells were producing. The results of tests made at this well show that there are two productive zones on this property with probable intermediate water between them. From results obtained at early wells drilled in this part of the field it was claimed that clean oil could not be produced from the first zone. The demonstration at M/C well No. 44 shows that early wells probably either did not have water shut off above, or penetrated intermediate water below this zone. The first oil zone has been found over an area about as large as a quarter section and has not been tested by wells drilled since M/C well No. 44.

A peg model has been constructed covering all of the western and nearly all of the eastern portion of this field. The model of the latter part shows distinctly that there are two oil zones in the S.  $\frac{1}{2}$  of the N. E.  $\frac{1}{4}$  of Sec. 23 and S.  $\frac{1}{2}$  of N. W.  $\frac{1}{4}$  of Sec. 24, T. 3 S., R. 10 W., S. B. B. & M. Recent developments indicate that this zone does not extend as far north along the east line of Section 23 as the second oil zone. A test made of the first zone in a well located on the southern edge of the present producing area along the west line of Section 24 showed that the first zone had comparatively little oil in the sands comprising the upper part of the zone and that there was either edge water in the lower part of the zone or water immediately below. The well in which the test was made is being deepened, water to be shut off below the first zone and the second zone tested for production. The north and east limits of the first zone are fairly well defined. This zone is worth protecting from water, as five wells obtaining their production from it during June, 1918, averaged 129 barrels of oil and 3 barrels of water per day. Future wells drilled in the western part of the N. E.  $\frac{1}{4}$  of Sec.

23, T. 3 S., R. 10 W., S. B. B. & M., possibly could develop oil in commercial quantities from the upper zone, and later, if deemed advisable, deepen to the second zone.

Repair work on wells located on both sides of the south line of Sec. 13, T. 3 S., R. 10 W., S. B. B. & M., caused a material reduction in the water production of two wells in this area. Other wells in the vicinity will probably be worked upon during the coming year in order to reduce, if possible, the amount of water produced by them. One well which was producing a large amount of water and a small amount of oil was plugged and abandoned during the fiscal year.

Following is a tabulation showing written notices received and written decisions made for the Coyote Hills field during the year:

Range- Township- Section	Company	New wells				Test of water shut-off				Deepen or redrill				Abandon			
		Orig.		Supp.		Orig.		Supp.		Orig.		Supp.		Orig.		Supp.	
		Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
21-3-10	Union Oil			2	3	1	1										
22-3-10	Union Oil					1	1										
22-3-10	Standard			3	3	3	1										
23-3-10	Union			1	1	2	5										
23-3-10	Amalgamated Oil	1	1			3	6	1	1	1	1			1	1		
24-3-10	Strain, Thos.							1	1	1	1						
24-3-10	Petroleum				2	1	3										
24-3-10	Amalgamated Oil	2	2	1	1	2	5										
28-3-10	Union			1	2	1	1										
4-3-11	Union			1	1	1	1										
13-3-11	Standard			1	1	2	3							1	1		
24-3-11	Standard	1	1	4	7	4	9	1	1					1	1	1	1
18-2-9	Union	1	1			2	4	2	2	1	3						
18-3-9	Standard													1	1	1	1
19-3-9	San Diego Consolidated				1	1	3	2	1					1	1	1	
19-3-9	Colokla						2	2	2				2				
19-3-9	Providential Oil							1	1					1	1		
19-3-9	Fetterman						8							2	3		
19-3-9	Fullerton Great West				2		6	2	1					1	1	1	
29-3-9	Union						1										
8-3-10	Tri-state						2							1	1		
13-3-10	Amalgamated					1	1	1	2					1	1	1	1
17-3-10	Standard	1	1	6	6	5	8										
18-3-10	Standard	5	7	8	8	15	24	1	2	1				2	2	1	1
19-3-10	Standard	6	6	6	6	5	6										
23-3-10	Standard	2	2			1	2										
Totals		19	21	31	44	51	100	14	14	3	6	13	14	6	6	4	

Study of the above tabulation shows that the Standard Oil Company and Amalgamated Oil Company carried on the greater portion of development work, the greatest activity being in the western portion of the field. Of the 29 wells completed in this field during the fiscal year, 14 are located in the eastern part, or what is sometimes referred to as "East Coyote." The remaining 15 wells are located in the western part, or "West Coyote" field. Wells in the western part of the field

made a much higher average per producing well than those in the eastern part during the year. One well in the western part of the field produced nearly 1,100,000 barrels of oil and 13,000 barrels of water during the last 11 months.

#### OLINDA FIELD.

The major portion of the development work in this field was carried on during the fiscal year by the Union Oil Company and Petroleum Development Company. Reference to Table 4 shows there were 13 wells completed during the year. Drilling was commenced on 17 wells. The production of all wells completed during the fiscal year amounted to 91.5 barrels oil and 16.2 barrels of water each per day during the month of June, 1918. Wells completed prior to July 1, 1917, made a total daily average of 6598 barrels of oil and 1250 barrels of water during June, 1918. This is a decrease for these wells of 1000 barrels of oil and an increase of 324 barrels of water for June, 1918, as against June, 1917. Wells completed during the fiscal year produced a total of 206,318 barrels of oil and 39,049 barrels of water during the year. The production for the fiscal year of wells completed prior to July 1, 1917, amounted to 2,703,103 barrels of oil and 393,850 barrels of water, making a total fluid production for the field during the fiscal year of 3,342,320 barrels, of which 2,909,421 barrels were oil and 432,899 barrels were water.

Table 8 shows 239 wells produced from 0-20 barrels of water, 13 wells from 20-40 barrels of water, 6 wells 40 or more barrels of water during June, 1918. Maps prepared by the department show that wells making 40 or more barrels of water per day are distributed throughout the field, excepting two localities, where there are a number of these wells in a group. Active repair work is in progress at one of these groups of wells in which an old well drilled several hundred feet below present productive measures is being cleaned out and re-plugged.

In view of the change in the system of one company in this field of reporting the amount of all water produced by their wells instead of the amount of water carried by oil in suspension after draining off the free water, there appears to be an increase of 407 barrels of water per day for this company. This accounted largely for the apparent increase in water of the total fluid production for June, 1918, as against June, 1917. There are other companies in this field who are still using this system and consequently fail to file correct production reports with the department.

There has been practically no extension of the proved area in this field by wells completed during the fiscal year. Nearly all of such wells are located within the area considered proved in the Second

Annual Report. At present there is one well producing for every 5.3 acres of proved land in this field.

As a result of recent study of underground conditions on the property of the Petroleum Development Company, in this field, one well which had been producing for approximately 17 years from a depth of 664 feet was deepened to 1465 feet and the production of the well increased from 3 barrels per day to 80 barrels per day. The gravity of this oil is 19.8° Baumé and the water content amounted to only 0.26 barrels. As a result of the success of this work the company are at present engaged in deepening other wells on the property.

The following tabulation is a summary of notices received and decisions rendered by the department for this field during the past year. Reference to this table shows that nearly all the development in this field related to the drilling of new wells.

Range- Township- Section.	Company	New wells		Test of water shut-off		Deepen or redrill		Abandon	
		Orig.	Supp.			Orig.	Supp.	Orig.	Supp.
		Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
7-3-9	Union	2	2	2	4	1	1	1	
8-3-9	Petroleum Development	5	5	2	4	12	8	3	2
8-5-9	West Coast	1	1	2	2	2			
8-3-9	Olinda Land					1	1	1	
8-3-9	Columbia Oil Producing	1	1						
8-3-9	Union	2	2	2	4	3	4	1	1
17-3-9	Olinda Land	2	2						
17-3-9	Union	3	3						
16-3-9	Olinda Land	1	1					1	1
	Totals	17	17	8	14	18	16	6	5

### BREA CAÑON FIELD.

Table No. 1 shows that there were 64 wells producing in this field during June, 1918. Table 9 shows that wells completed prior to July 1, 1917, had a total fluid production during the past fiscal year of 2,275,823 barrels. Of this amount 1,614,068 barrels were oil and 661,755 barrels were water, or 29 per cent of the total fluid production was water. Only one well was completed during the past fiscal year and produced during June, 1918, a total of 1196 barrels of fluid, of which amount 1172 barrels were oil and 24 barrels were water, or the water amounted to 2 per cent of the total fluid produced. The production of all wells in the field during the fiscal year amounted to 2,277,019 barrels, of which amount 1,615,240 barrels were oil and 661,779 barrels were water, or 29 per cent water.

Wells completed prior to July 1, 1917, produced at the average rate of 4204 barrels of oil and 1830 barrels of water per day during June,

1918. This is a decrease in the daily production of these wells as shown in June, 1917, of 513 barrels of oil and 202 barrels of water.

During June, 1918, there were 49 wells producing from 0-20 barrels of water, 4 wells producing from 20-40 barrels of water, and 11 wells producing 40 or more barrels of water daily.

There are two well defined areas in Section 2, T. 3 S., R. 10 W., S. B. B. & M., in which wells are seriously affected by water. One of these areas is located along the north line of the section in which 4 wells each averaged 73 barrels of water per day during June, 1918.

The other area is located in the southwestern part of the developed portion of the section, in which area 10 wells each averaged 133 barrels of water daily during the same month.

These two groups, comprising 14 wells, produced 87 per cent of all the water produced in the field during the month of June, 1918.

The water condition of the affected areas has shown only slight improvement during the fiscal year, which would indicate that the water is being produced from water-bearing formations penetrated in certain of the wells and is probably not return drilling water, as was believed to be the case by some of the operators in the field. This is further borne out by the fact that there was little drilling activity in the field during the past fiscal year. The large amounts of water used in wells being drilled or repaired could, no doubt in some cases, be reduced by "mudding up" certain sands known to be very porous, thus reducing the amount of water used and consequently the amount of water allowed to enter the oil-bearing formations.

Acting upon recommendations of this department, the Birch Oil Company successfully plugged the lower portion of their well No. 12 on Section 2, T. 3 S., R. 10 W., S. B. B. & M., and reduced the daily water production of this well from about 250 barrels to about 35 barrels and increased the daily production of oil from about 20 barrels to 35 barrels. The production of oil from this well will probably be greatly increased when casing opposite upper oil sands, formerly cased off, is perforated. Recent tests made of the production of an adjoining well on this property show a considerable betterment in its water condition, possibly due to work performed on well No. 12.

The following tabulation giving a summary of notices received and decisions rendered by the department during the fiscal year shows that there was little activity here during the year:

Range Township Section	Company	New wells		Test of water shut-off		Deepen or redrill		Abandon	
		Orig.	Supp.	Notices	Decisions	Orig.	Supp.	Orig.	Supp.
		Notices	Decisions			Notices	Decisions	Notices	Decisions
2-3-10	Brea Canyon					1		2	
2-3-10	Columbia Oil Producing	1	1	2	2	1	1	2	1
2-3-10	Birch			2	2	1	1		
	Totals	1	1	2	2	3	2	2	1

### PUENTE FIELD.

The term Puente field, as used in this report, includes in addition to the known productive area of the old Puente field, located mainly in Sections 34 and 35, T. 2 S., R. 10 W., S. B. B. & M., in the Puente Hills, the western portion of the Rancho La Puente, west of the town of Puente, upon which the Shell Company of California is operating. Actual development work was carried on in various parts of this field by the Shell Company of California, Petroleum Development Company, Copa De Ora and Gold Seal Petroleum companies. Up to the present time no oil has been produced by any of these new wells, the only production being reported from wells in the old field.

Table 1 shows there were 44 wells producing in the month of June, 1918, all of these wells having been completed prior to July 1, 1917. These wells produced a total of 19,415 barrels of oil and 1838 barrels of water, or 8.6 per cent of the total fluid produced was water. The average daily production of this field for June, 1918, was 54 barrels of oil and 5 barrels of water. This shows a decrease of 8 barrels of oil and 1 barrel of water from the average daily production for June, 1917.

The following table is a summary of notices received and decisions made by this department relative to this field during the past fiscal year:

Range Township Section	Company	New wells		Test of water shut-off		Deepen or redrill		Abandon	
		Orig.	Supp.	Notices	Decisions	Orig.	Supp.	Orig.	Supp.
		Notices	Decisions			Notices	Decisions	Notices	Decisions
2-10	Petroleum Development				3	1			
9-2-9	A. T. Currier		1	1		2		1	1
11-2-11	Shell	1	1						
	Totals	1	1	1	3	3		1	1

## WHITTIER FIELD.

There are 526 acres of proved oil land in the field, an increase of 25 acres since the previous fiscal year.

Table 1 shows that 148 wells were producing in this field in June, 1918. During this month these wells averaged 2,755 barrels of oil and 2,364 barrels of water per day, or an average daily production of 18 barrels of oil and 16 barrels of water per producing well per day. Table 8 shows that, during June, 1918, there were 123 wells producing from 0-20 barrels water, 9 wells producing from 20-40 barrels water, and 16 wells producing 40 or more barrels water daily.

There were 10 wells completed during the fiscal year. These wells produced a total of 85,713 barrels of oil and 71,492 barrels of water during the year. Wells completed prior to July 1, 1917, produced a total of 1,016,740 barrels of oil and 942,188 barrels of water. This makes a total production of 1,102,453 barrels of oil and 1,013,680 barrels of water, or 48 per cent water, for all wells during the last fiscal year.

Wells completed prior to July 1, 1917, produced an average of 2,438 barrels of oil and 2,318 barrels of water per day during June, 1918. This is a decrease in the daily production of these wells of 784 barrels of oil and 306 barrels of water for June, 1918, as against their production for June, 1917.

The number of producing wells and their production of oil and water for June, 1917, and June, 1918, is given in the following tabulation:

	Number producing wells	Average daily production		Average daily production per producing well		Percent- age of water
		Bbl. oil	Bbl. water	Bbl. oil	Bbl. water	
June, 1917 -----	139	3,222	2,624	23	19	44.9
June, 1918 -----	148	2,755	2,364	18	16	46

Study of the above tabulation shows that the Whittier field produced 467 barrels of oil and 260 barrels of water less per day in June, 1918, than the same month of 1917. The average daily production per producing well declined 5 barrels in oil and 3 barrels in water during the year. These figures show that a larger drilling campaign than during the last year will have to be carried on in order that this field may maintain its present oil production. There is little or no doubt but that the amount of water produced by certain wells in this field seriously affects their oil production.

One well, located near the N. W. corner of Section 26, T. 2 S., R. 11 W., S. B. B. & M., completed during the fiscal year, produced a total

of 47,016 barrels of water, or 65.1 per cent of the water produced by all wells completed during the year. This well was drilled through the first and second oil zones and into the third oil zone. Recent repair work begun and tests made on this well indicate that the source of water is intermediate water between the second and third oil zones. This well did not produce during June, 1918.

The well referred to under Table 4 as producing 67 per cent of all water produced in June, 1918, by wells completed during the fiscal year is located near the west line of the S. E.  $\frac{1}{4}$  of Section 22, T. 2 S., R. 11 W., S. B. B. & M. This well averaged about 30 barrels of oil and 40 barrels of water per day. This well effected a complete shut off above the upper oil, and from the fact that the well was drilled deeper stratigraphically than neighboring wells, it is probable that water-bearing formations were encountered below the shut-off point. The structure of this field, and more particularly Sections 22, 23 and 26, T. 2 S., R. 11 W., S. B. B. & M., is given in considerable detail in Bulletin No. 82, Second Annual Report of the State Oil and Gas Supervisor. In Section 26, previously mentioned, there are three distinct oil zones with intermediate water between each zone. The distance from the top of the first zone to the top of the second zone averages about 500', and the average distance from the top of the second zone to the third zone is about 600'. Developments during the fiscal year indicate that the prospects of extending the southern portion of the field in a southeasterly direction in Section 25 of the above-mentioned township and range are probably better than in any other direction. One well located near the N. W. corner of the S. W.  $\frac{1}{4}$  of Section 25, completed in April, 1918, in accordance with recommendations issued by this department, was drilled to a certain depth into the first oil zone, and tested in order to determine the productiveness and water content of the zone at this well. The well averaged 77 barrels of oil and 4 barrels of water per calendar day up to July 1, 1918. The results of this test indicate the value of the first oil zone in this part of the field. Further deepening of this well should show whether or not the first oil zone continues and also the position of probable intermediate water between the first and second oil zones. Six wells produced only from the first oil zone during the fiscal year and averaged about 60 barrels of oil and 15 barrels of water each per calendar day. The source of the water produced by two of these wells was probably foreign to the zone itself, resulting possibly from intermediate water below and in another case failure to make a complete shut-off above the zone.

There are 8 wells producing only from the second zone on Section 26, T. 2 S., R. 11 W., S. B. B. & M. The average daily production of these wells amounted to 98.8 barrels of oil and 0.35 barrels of water per day

during the fiscal year. One well producing from the third zone only averaged 39.1 barrels of oil and 0.0 barrels of water during the same time. This well is located near the north line of the N. W.  $\frac{1}{4}$  of the section. A test of the productiveness of the third zone is being made on a well located near the center of the section. A shut-off to be made immediately above the third zone, the second zone to be protected by the use of mud and cement. All other wells on this section probably produce from more than one zone and make nearly all the water produced by wells in this section. This indicates that the source of water produced by the latter wells is between the zones, or intermediate water, or failure to exclude water from above the first zone.

Water should be effectively shut off above the first oil zone in each new well drilled in the southeastern part of the field, so that this zone may be properly protected from water above it even though a shut-off is made below the zone in order to produce from the second zone. The matter of protecting the first zone from intermediate water between it and the second zone, in wells shutting off this zone to produce from lower zones, is one that merits the careful consideration of all operators concerned.

The fact that the total fluid produced by this field during the last fiscal year amounted to 48 per cent water shows the necessity of certain repair work on old wells and a definite policy in the matter of drilling new wells in order that the various oil zones which may be shut off receive the protection that their value warrants. The department recommended the use of mud-laden fluid to aid in protection of the first zone in wells cementing casing below it, the purpose of the mud being to seal the porous formations, even though only temporarily to permit the rising of a column of cement to the desired height back of the casing to be cemented, and keeping the cement in its proper position for a sufficient length of time for it to take its initial set. The mud-laden fluid method of aiding in the protection of oil zones shut-off does not seem to be very well understood by operators in this field and, therefore, has not been properly tried so as to determine its effectiveness.

Prospect work was started in two areas, one well being located in the N. W.  $\frac{1}{4}$  of Section 15, and the other two wells in unsurveyed Sections 8 and 9, all in T. 28, R. 11 W., S. B. B. & M.

The following tabulation shows the relative amounts of work instituted during the past fiscal year by various operators in this field:

Range Township Section	Company	New wells		Test of water shut-off		Deepen or redrill		Abandon	
		Orig.	Supp.			Orig.	Supp.	Orig.	Supp.
		Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
25-2-11	Fullerton	1	1	1	1	1	1	1	1
25-2-11	Standard	1	1	1	2	5			
25-2-11	Central	1	1			3	3	1	1
22-2-11	Home					1	2		
22-2-11	Standard	1	2	4	9	8	1	5	5
22-2-11	Central Oil	1	1		1	1	1		
15-2-11	Central	1	1		1				
9-2-11	Montebello Oil Syndicate	1	1						
8-2-11	Montebello Mascot	1	1						
26-2-11	Standard	7	7	5	18	19	1	5	2
Totals		15	16	10	31	35	8	13	8
								1	1

### MONTEBELLO FIELD.

The average daily production of oil increased in this field from 852 barrels in June, 1917, to 16,985 barrels in June, 1918. Reference to Table 1 shows that there were 22 wells producing in June, 1918, and that their average daily production per well was 772 barrels of oil and 73.6 barrels of water. During the fiscal year there was a total fluid production of 3,477,672 barrels, of which 3,263,389 barrels were oil and 214,283 barrels were water.

One well, located in the N. E.  $\frac{1}{4}$  of Section 1, T. 2 S., R. 12 W., S. B. B. & M., produced a total of 1,328,137 barrels of oil and 150,722 barrels of water, or a total of 40.7 per cent of all the oil and 70.3 per cent of all the water produced in the field. This well was drilled 1675 feet below the first oil-sand, and probably penetrated water-bearing formation below the shut-off point. A number of wells have been drilled in the northeastern part of this section (Section 1), in which water above the first oil sand was shut off in the usual manner and unperforated oil strings landed from 700' to 900' below the first oil sand, probably making a formation shut-off. These wells were completed with a second, and in some cases a third, oil string so as to produce only from formations penetrated in the lower portion of the well.

Clean oil has been obtained from all wells finished in this manner. Such a procedure leaves considerable doubt as to protection of upper oil formations, providing intermediate water has been passed through and cased off with the upper oil sands. Future wells drilled in this area should be so planned as to locate, if possible, any intermediate water. This possibly could be done by drilling the new wells deeper stratigraphically than the wells at present producing from the

upper formations and testing by stages, if necessary, to the depth from which the present deeper wells are producing. In other words, test for probable intermediate water-bearing formations between the upper and lower oil zones.

It is possible that both the water and oil bearing formations are lenticular in shape, in which case the water problem in this portion of the field will be difficult to solve and hard to handle, as in many cases it will be necessary to test deep wells before it will be known whether or not they passed through water. Wells completed in the north-central and northwestern portion of Section 6, T. 2 S., R. 11 W., S. B. B. & M., have had very little water trouble up to the present time. Practically every completed well in this area is producing from all oil-bearing formations penetrated below the shut-off point. Several of the wells here have been drilled from 1200' to 1500'; and one well 1725' below the shut-off point. Production reports show that none of these wells make water. Three wells along the southern edge of the area just described average from about 20 per cent to 40 per cent water and emulsion in their fluid production. The source of this water has not been determined. Two of these wells were drilled 1132' and 762', respectively, below the first oil sand, while the third well was drilled only 700' below the first oil sand. All three of these wells adjoin wells drilled deeper, stratigraphically, and which produce large amounts of clean oil. The three wells under consideration are all on about the same contour, which suggests the possibility of an intermediate edge water, particularly in view of the production of clean oil from the adjoining wells up slope. One of the wells has been plugged to within about 600' of the top of the first oil sand without materially improving its water condition. Future developments should show whether or not the water in the three wells just described has any relationship to water penetrated in the wells mentioned in the following paragraph.

Water was encountered in one well along the Standard-Union line in Section 1, T. 2 S., R. 12 W., S. B. B. & M., after drilling 559' below the first oil sand. The lower portion of the well was plugged with cement and successfully excluded all water. Work is in progress plugging the lower portion of two other wells along this line in order to shut off water.

The results so far attained in the area under consideration show that it is comparatively safe to drill wells about 525' below the top of the first oil sand without encountering water. In view of the wells drilled in this section which have penetrated various oil-bearing formations from 1500' to 1700' below their shut-off point, it seems reasonable to assume that oil-bearing formations exist below the water penetrated by wells along the Standard-Union line, and the water penetrated in these wells may be an intermediate edge water.

A well drilled in Section 2, T. 2 S., R. 12 W., S. B. B. & M., to a depth of 920' below the shut-off point has been shot in several places and plugged with cement up to within 650' of the shut-off point. After this plugging the well averaged about 300 barrels of oil and 100 barrels of water per day, indicating that the source of the water is above the top of the cement plug. In order to secure additional information as to the source of the water in this part of the field the owner of the well is drilling an adjoining well in which this company are planning to drill to a lesser depth stratigraphically than the top of the plug in the former well and test by pumping, and later on, if necessary, possibly deepen in stages and conduct further tests.

Two wells have been completed in the S. W.  $\frac{1}{4}$  of Section 31, T. 1 S., R. 11 W., S. B. B. & M. One well was drilled 485' and the other 595' below the first oil-bearing formation penetrated. The former well averaged about 300 barrels of oil per day and 35 per cent water thirty days after completion. The other well produced mostly water when first tested and at present is standing with a cement plug extending 115' from bottom.

Two wells have been completed east of the Rio Honda, in Section 6, T. 2 S., R. 11 W., S. B. B. & M. One of these wells was drilled 400' below the first oil-bearing formation and encountered water-bearing formation near the bottom. This well has a cement plug, extending about 100' from bottom, which shuts off the water. The other well was drilled 218' below the first oil-bearing formation and is producing clean oil. Results obtained in certain wells drilled in this section immediately west of the Rio Honda, in which from 1200' to 1500' of oil-bearing formations were penetrated, indicate the possibility that productive oil formations exist below the water in the well under consideration which has the cement plug in the bottom.

Water was shut off in one of the early wells drilled in Section 6, T. 2 S., R. 11 W., S. B. B. & M. about 700' above the first oil formation. In view of this the department recommended that the owner of the well stop drilling, and test the well before drilling below a specified depth. The result of the subsequent test showed that the well averaged over 50 per cent water in its fluid production. There is little doubt but that water from above the oil formation is entering the well as adjoining wells, down slope, drilled deeper stratigraphically are producing clean oil. The matter of repair of the well has been taken up with the owner who has been furnished the department's estimate of the depth at which water should be shut off. With a few exceptions, water was shut off above the first oil-bearing formation penetrated in each well in the field.

Operators were not required to shut off above, or protect from water, oil-bearing formations which the department considered of no commercial importance. Special importance was attached by the department to

uniform stratigraphic shut-off, as some of the older oil fields of the State have been seriously damaged by neglect of such vital factor in their protection from water.

The information given in this report relative to water conditions in certain areas of the Montebello Field show that water is proving a serious obstacle in the development of this field. In order to successfully cope with this problem it will be necessary to do a certain amount of prospecting and testing. Such work should be systematically directed along proper engineering lines, taking advantage of study of peg models, cross sections, underground contour maps and chemical analyses of water produced by various wells.

The department has a complete and up-to-date peg model showing a graphic representation of all wells completed and drilling in the field. Contours of the first oil-bearing formation penetrated by the various wells has been sketched on the boards comprising the base of the model. All property and section lines are also shown. A number of cross sections have been made and all available data on chemical analyses of water from wells has been gathered. The responsibility of the future of this field rests largely upon the operators themselves, who in some cases, are not availing themselves of the benefits which would result from the employment of technical assistance.

The gravity of the oil produced in the Montebello field ranges from 14 to 28 degrees Baumé, inclusive. Wells producing from the lower formations penetrated produce the higher gravity oil. The gravity of oil produced by wells in Sec. 1 T. 2 S., R. 12 W., S. B. B. & B., located along the Standard-Union line ranges from 17 degrees to 22 degrees, inclusive. One well in N. E.  $\frac{1}{4}$  of Section 2, in the same township and range, averages about 15 degrees. The oil from wells, located in the northern part of Sec. 1 T. 2 S., R. 12 W., S. B. B. & M. and north western part of Section 6, T. 2 S., R. 11 W., S. B. B. & M., penetrating and producing only from upper oil zone ranges in gravity from 22 degrees to 25 degrees, while the gravity of oil produced from the upper zone by wells in Section 31, and east of the Rio Honda in Section 6, T. 2 S., R. 11 W., S. B. B. & M., averages about 19 degrees.

Further study of the gravity of oil produced by wells in this field may throw some light on the water problem.

#### History of Development.

T. 2 S., R. 12 W., S. B. B. & M.

##### *Section 1.*

Drilling was commenced by the Standard Oil Company, on "Baldwin" well No. 1, the first well in the Montebello field, on December 12, 1916. This company now has 18 producing wells and 10 drilling wells in this section (see fig. 9). The Union Oil Company has six wells producing

and 2 wells drilling. The Petroleum Midway and Columbia Oil Producing Company are each drilling one well.

### *Section 2.*

The farthest westward producing wells, Standard Oil Company "Baldwin" well No. 4, located near the top of the anticline and Petroleum Midway Company "Mullholland" well No. 1, located on the south flank of the anticline are both in this section. The former well is in the N. E.  $\frac{1}{4}$  and the latter well in the S. E.  $\frac{1}{4}$  of the section. The Petroleum Midway Company "Howard and Smith" well No. 1, located near the S. E. corner of the S. W.  $\frac{1}{4}$  was drilled to a depth of about 3375', and after some work in sidetracking casing farther up the hole was shut down. No oil bearing formation was reported as having been penetrated in this well. The same company is drilling a well near the S. E. corner of the S. W.  $\frac{1}{4}$  known as "Oswald-Stephens" well No. 1. This well is drilling at a depth of about 2800'. General Petroleum Corporation "Ralph" well No. 1, located near the south line in the S. E.  $\frac{1}{4}$  is drilling at a depth of about 3100'. The Union Oil Company is drilling three wells along the north line of their property, in the S. E.  $\frac{1}{4}$  of the section. The Riverside Portland Cement Company and Baldwin-Stocker Oil Estates are carrying on active development work in the N.  $\frac{1}{2}$  of this section.

### *Section 3.*

There are two drilling wells near the N. S. center line, in the N.  $\frac{1}{2}$  of this section. One of these wells is being drilled by the Interstate Oil Company and has reached a depth of 3350'. The other well "Bicknell" No. 1 was drilled by the Pan American Petroleum Company to a depth of about 3075' and then shut down.

### *Section 12.*

The Montebello Oil Syndicate is drilling a well near the east line of the N. E.  $\frac{1}{4}$  of the section. The well has reached a depth of about 1500'.

T. 1 S., R. 12 W., S. B. B. & M.

### *Section 25.*

The General Petroleum Corporation is drilling "Lieber" well No. 1, located in Lot 7, in the S. E.  $\frac{1}{4}$  of Section 25. This well has reached a depth of about 2300'.

### *Section 26.*

The General Petroleum Company is drilling "Garvey" well No. 1, located in the S. W.  $\frac{1}{4}$  of Section 26. This well is drilling at a depth of about 2250'.



*Section 33.*

Pan American Petroleum Company "Hellman" well No. 1, located in the S. W. corner of the section was drilled to a depth of 2450', and shut down. No oil has been reported in this well.

*Section 35.*

Drilling was commenced on four wells in this section during the fiscal year. Two of the wells are located in the N. E.  $\frac{1}{4}$ . One of these wells, owned by the Rice Ranch Company, is drilling at a depth of about 3200', the other well "Valley View" No. 1 owned by the Union Oil Company is drilling at a depth of about 1800'. The Pan American Petroleum Company drilled "Tri-City" well No. 1, located in the S. W. corner of the S. W.  $\frac{1}{4}$ , to about 3900', without developing any oil. This well has several hundred feet of the lower portion plugged off and tests are being conducted of formations passed through in the original drilling. Adjoining well No. 3, of the Baldwin-Stocker Oil Estate was shut down when drilled to a depth of about 1400'.

*Section 36.*

The Amalgamated Oil Company "Connor" well No. 1, located near the center of the section is drilling at a depth of about 3250'. California Star Oil Company "Comte" well No. 1 was drilled to a depth of 1100' and abandoned.

T. 1 S., R. 11 W., S. B. B. & M.

*Section 28.*

The Union Oil Company is drilling "Slaughter" well No. 1, located in the S. E. corner of the section. The well has reached a depth of about 2500'.

*Section 31.*

There are two producing wells in this section. Standard Oil Company "Baldwin" No. 16, and Petroleum Midway Company "Darlington" No. 1. "Taylor" well No. 1, owned by the latter company, was shut down after being drilled to about 2700' when mechanical troubles developed. The latter company is drilling "Darlington" No. 2, located along San Gabriel Boulevard, between "Darlington" No. 1 and "Taylor" No. 1. California Star Oil Company drilling "Bargsten" well No. 1, known as the "Triangle" well, ceased operations, when a depth of about 3200' had been reached. All of the foregoing wells mentioned are located in the S. W.  $\frac{1}{4}$  of the section. General Petroleum Corporation "Alvitre" well No. 1, drilling at a depth of about 2950', is located near the south line of the S. E.  $\frac{1}{4}$ .

*Section 32.*

The Amalgamated Oil Company "Durfee" well No. 1 is located near the S. E. corner of the S. W.  $\frac{1}{4}$ . This well is drilling at a depth of about 2800'. The Five Star Oil Company is drilling "Irwin" well No. 1, in the S. E. corner of the section and are testing formations below a depth of 3160'. The General Petroleum Corporation "Stone" well No. 1, located near the S. E. corner of the S. W.  $\frac{1}{4}$  of the section has been drilled to a depth of about 3000'.

T. 2 S., R. 11 W., S. B. B. & M.

*Section 5.*

The Shell Company of California is drilling a well, near the east line of the N. E.  $\frac{1}{4}$  of the section. The Red Star Petroleum Company are drilling "Sanchez" well No. 1, located near the north line of the S. W.  $\frac{1}{4}$  of the section. The Potter Oil Company of California and Keeler and Tausig are each drilling a well in the S. W.  $\frac{1}{4}$  of the section. The former well has been drilled to a depth of about 3100' and the latter well to a depth of about 2000'.

*Section 6.*

The General Petroleum Corporation completed "Cruz" well No. 1. The first oil-bearing formation was penetrated in this well at a depth of 2077'. This company is drilling "Alvitre" well No. 2, located near the north line of the section. First oil-bearing formations have been reported in this well, and the well is being drilled into the oil formations, below the shut-off point. Red Star Petroleum Company "Baldwin" well No. 2, located near the S. E. corner of the N. W.  $\frac{1}{4}$  of Section 6, was shut down after a depth of about 2800' was reached. No oil was developed at this well. The same company has "Baldwin" well No. 5, offsetting General Petroleum "Cruz" well No. 1, in which oil-bearing formations were reported, and the well shut down shortly after the water string was recemented. The Red Star Petroleum Company have a total of 5 drilling wells and 2 producing wells in Section 6. The Petroleum Midway Company "Pioma-Briano" well No. 1, located in this section, is producing clean oil after the lower portion of the well had been plugged. "Pioma-Briano" well No. 2 of this company has reported first oil. "Walter" well No. 1 of the same company has been recemented after penetrating the oil-bearing formation. Both of these wells are in the east central part of Section 6, and have been shut down, after recementing. The Petroleum Midway Company have a total of 4 drilling wells and 2 producing wells in this section. Doheny-Pacific Petroleum Company "Pasadena" well No. 1, located near the S. E. corner of the N. W.  $\frac{1}{4}$  of the section, were unable to test first

bearing formations encountered on account of casing trouble and are now testing formations penetrated below a depth of 3035'.

The McGinley Oil Company has 4 wells producing and 1 well drilling.

### *Section 7.*

The St. Helens Petroleum Company is operating in this section and is drilling well No. 1, located near the N. E. corner of the N. W. 1.

Developments in the Montebello field show that the top of the anticlinal dome broadens out on its west plunge from its apex, near Standard Oil Company "Temple" well No. 3, in Section 6, T. 2 S., R. 11 W., toward Standard "Baldwin" No. 4 in Section 2, T. 2 S., R. 12 W. In view of this it is difficult to locate the exact top of the anticline in Sections 1 and 2. There are not a sufficient number of wells drilled on the east plunge of the anticline to accurately determine the exact direction of its axis. However, late drilling operations indicate that the axis of the anticline turns toward the south from its apex in Section 6. The average maximum dip of the developed portion of the south flank of the anticline near the center of Section 1, T. 2 S., R. 12 W., is about  $20^{\circ}$  with the direction of strike about S.  $82^{\circ}$  W. as shown by the peg model in the office of the department. Surface dips of formations here range from  $25^{\circ}$  to  $50^{\circ}$ . There is evidently a steepening in dip of the south flank of the anticline toward the south line of Section 2, T. 2 S., R. 12 W., as a well in the south east corner of this section has reached a depth of about 3100' without reporting oil bearing formations. The south flank of the anticline dips an average of about 30 degrees with the direction of strike about S.  $72^{\circ}$  W. in the center of Section 6, T. 2 S., R. 11 W., in the developed area. Wells recently completed in Section 31, T. 1 S., R. 11 W., show that the north flank of the anticline dips about 35 degrees from the top of the anticline toward these wells. Results reported from wells drilling north of these wells in this section, show a still greater dip or failure of the upper oil-bearing formations to extend any considerable distance beyond the completed wells referred to. Results in general obtained along the north flank of the anticline indicate that this flank has a greater degree of dip than the south flank. The productive area of the eastern end of the field should be soon determined with the present rate of development. There is comparatively little activity in the western end of the field, the major portion of present work being along the axis and on the south flank of the anticline.

Table 10 shows that notices were received by the department to drill 73 wells in this field during the fiscal year. This is 53 per cent of all such notices received during this time. Up to July 1, 1918, a total of 84 notices to drill wells in this field were received since drilling was commenced at the first well on December 12, 1916.

Following is a summary of all written notices received and decisions rendered by the department during the fiscal year.

Range- Township- Section-	Company	New wells		Test of water shut-off		Deepen or redrill		Abandon	
		Orig.	Supp.			Orig.	Supp.	Orig.	Supp.
		Notices- Decisions-	Notices- Decisions-	Notices- Decisions-	Notices- Decisions-	Notices- Decisions-	Notices- Decisions-	Notices- Decisions-	Notices- Decisions-
28-1-11	Union	1	1						
31-1-11	California Star Petroleum	1	1		1				
6-2-11	Petroleum Midway	6	6	2	5	6	3		
6-2-11	Red Star Petroleum	5	5	1	3	3	4		
5-2-11	Keeler & Tausig	1	1						
5-2-11	Potter	1	1						
5-2-11	Shell Co. of California	1	1						
35-1-11	Shell Co. of California	1	1						
32-1-11	General Petroleum Corp.	1	1						
32-1-11	Five Star	1	1						
32-1-11	Amalgamated	1	1						
31-1-11	Standard	1	1		1	3			
31-1-11	General Petroleum Corp.	1	1		2	2			
31-1-11	Petroleum Midway	2	2	1	2	1			
6-2-11	Standard Oil	8	8	7	7	13	15		
3-2-12	Pan-American Petroleum	1	1						
3-2-12	Interstate	1	1		1				
2-2-12	General Petroleum Corp.	1	1	1	1				
2-2-12	Union	1	1						
2-2-12	Petroleum Midway	2	2	1	1				
2-2-12	Baldwin-Stocker Oil Estates			5	4	3	2		
2-2-12	Riverside Portland Cement	1	1			1	1		
2-2-12	Standard	1	1	5	5	3	3		
1-2-12	Petroleum Midway	1	1	1		1	1		
1-2-12	Union	5	5	7	4	7	9		
6-2-11	McGinley	3	3	3	3	3	3		
6-2-11	General Petroleum Corp.	1	1						
6-2-11	California Star	1	1						
6-2-11	St. Helens Petroleum	1	1						
6-2-11	Doheny-Pacific Petroleum	1	1						
33-1-12	Pan-American Petroleum	1	1		1				
35-1-12	Pan-American Petroleum	1	2	7	4	2	3		
35-1-12	Rice Ranch	1	1	1	1	2	2		
35-1-12	Union	1	1						
35-1-12	Baldwin-Stocker Oil Estates	1	1						
36-1-12	Amalgamated	1	1	3	3				
36-1-12	California Star	1	1	1				1	1
1-2-12	Standard	11	10	17	15	24	28		
	Totals	73	72	62	57	79	81	1	1

### SALT LAKE FIELD.

The total fluid production of this field during the year amounted to 1,902,772 barrels, of which 1,134,797 barrels were oil and 764,975 were water, or 40.2 per cent water.

Reference to Table 1 shows this field to have produced an average total of 2949 barrels of oil and 1,998 barrels of water per day during June, 1918. This is a decline of 487 barrels of oil and 188 barrels of water per day during the fiscal year. No wells were drilled in this field during the year.

The decrease in the amount of oil therefor represents the natural decline in the production of the producing wells.

A detailed description of work done in shutting off water penetrated below the oil-bearing formations in Rancho La Brea Well No. 41, Sec. 15, T. 1 S., R. 14 W., S. B. B. & M., by the mud-laden fluid method, as recommended by this department, is given on pages 162 to 168, inclusive, in Bulletin No. 82, Second Annual Report of the State Oil and Gas Supervisor. After the water sand below the oil sand was entered and before the well was mudded the water stood about 170' from the surface. A total of about 770 cubic yards of adobe and 50 cubic yards of sawdust were pumped into the lower portion of the well, under a pressure of about 400 pounds per square inch. Following the final mudding operation the well was shut down. A representative of the department visited the well about three months after mudding operations had been completed and found that the water stood at the surface and that mud-laden fluid stood 140 feet from the surface.

Salt Lake Oil Company wells Nos. 329, 330, 347 and 348 in Section 22, adjoining Section 15 on the south, and Rancho La Brea Oil Company Well No. 38, were directly affected as each of these wells pumped a mud solution shortly after mudding operations were started in Rancho La Brea Well No. 41, necessitating the shut down of these wells, while the mudding operation was in progress. These wells produced a total of 9,273 barrels of oil and 50,717 barrels of water, or 84.5 per cent water during a period of one year previous to mudding operations. The same wells produced a total of 24,669 barrels of oil and 47,588 barrels of water, or 65.8 per cent water for a period of one year following mudding operations on Rancho La Brea Well No. 41. This is an increase of 15,396 barrels of oil and a decrease of 3,129 barrels of water, or a decrease from 84.5 per cent water to 65.8 per cent, due, evidently, to work performed at Rancho La Brea Well No. 41, as immediately previous to work at this well the affected wells produced only a comparatively small amount of oil and a large quantity of water. Previous to the time that water sand was penetrated in Rancho La Brea Well No. 41, the above mentioned wells averaged approximately 70 per cent water in their fluid production. The water sand in Rancho La Brea Well No. 41 had been penetrated about 15 months previous to commencement of the mudding operations. Study of the foregoing data shows that Rancho La Brea Well No. 41 was not the principal cause of the water trouble in the adjoining Salt Lake wells.

Table 8 shows that there were 236 wells producing from 0-20 barrels of water; 11 wells producing from 20 to 40 barrels of water and 20 wells producing 40 barrels or more water in the Salt Lake field during the fiscal year. There was little change from the previous year in the number of wells producing these amounts of water.

Study of the following summary of notices received and decisions rendered during the fiscal year, shows that there was very little work done on wells in this field during the year.

Range Township Section	Company	New wells		Test of water shut-off		Deepen or redrill		Abandon	
		Orig.	Supp.	Notices	Decisions	Notices	Decisions	Notices	Decisions
		Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
25-1-15	West Coast			1	1				
28-1-14	Rancho La Brea					1	1		
29-1-14	Garbutt							1	2
16-1-14	Rancho La Brea			1	1	3	3	2	1
15-1-14	Rancho La Brea			1	1				
Totals				3	3	4	5	2	3

### NEWHALL FIELD.

The work in this field was handled from January, 1918, to June, 1918, inclusive, by Irving V. Augur, Deputy Supervisor, located at Santa Paula, on account of the field being more accessible to the Santa Paula office.

Records show that three new wells were completed in this field during the past fiscal year. These wells produced a total of 825 barrels of oil and 1994 barrels of water during this time, but as pointed out elsewhere in this report one of these wells produced in one month 1364 barrels of water, or 66.8 per cent of the total amount of water produced by the new wells during the entire fiscal year.

Wells completed prior to July 1, 1917, produced during June of that year an average of 362 barrels of oil and 325 barrels of water per day. In June, 1918, the average daily production of these wells was 326 barrels of oil and 362 barrels of water, showing that the average daily oil production of these wells decreased 36 barrels and the average daily water production increased 37 barrels.

The total fluid production of the field during the past fiscal year was 251,945 barrels, of which 119,289 barrels were oil and 132,656 barrels were water, or 52.7 per cent of the total fluid production was water.

Table 8 shows that 74 wells produced 0-20 barrels of water; 3 wells produced from 20-40 barrels of water and 2 wells produced 40 or more barrels of water daily. This shows that there are comparatively few wells producing large amounts of water. The water production during June, 1918, amounted to 4.6 barrels and the oil production was 4.1 barrels per well per producing day during this month.

The following tabulation is a summary of the notices received and decisions made by this department relative to the work in this field during the past fiscal year. Comparison of figures shown in this table with those in a corresponding table for the fiscal year of 1916-17, shown

on page 169 of Bulletin No. 82, Second Annual Report of the State Oil and Gas Supervisor, show an increased activity in the work of this field. Study of these two tables shows that notices were received for 9 new wells, 11 tests of water shut-off, 16 to redrill and 4 to abandon during the past fiscal year as against notices for 4 new wells, 9 tests of water shut off, none to redrill and 4 to abandon during the 1916-1917 period.

Range Township Section.	Company	New wells		Test of water shut-off	Deepen or redrill		Abandon						
		Orig.	Supp.		Orig.	Supp.	Orig.	Supp.					
		Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions		
2-3-17	Standard					3	3	1		1	1		
7-3-15	Standard	1	1			2	2	1	1				
20-5-16	Wheat & De Forest	1	1							1	1		
19-5-16	W. W. Stabler					1	1						
16-3-16	Standard	2	2	1	1	3	4	9	9	2	2		
13-3-16	E. A. Clappitt											1	1
12-3-16	E. A. & D. L. Clappitt	2	2		1							1	1
31-4-15	June Oil	1	1										
18-3-15	Buick Oil	1	1		2	2	2	2					
6-3-15	Tunnel Petroleum	1	1	3	3	3	2						
1-2-15	Crafton Oil											1	
Totals		9	9	4	4	11	10	16	16	3	2	4	3
												1	1

### MISCELLANEOUS FIELDS.

#### Dominguez Field.

During the fiscal year notices of intention to abandon 3 of the 4 wells commenced the previous year, were received. One well in this field was drilled with a rotary to a depth of 5000'; 8¼" casing was landed in this well at a depth of 3970'. No oil-bearing formations were reported as having been penetrated. One of the wells abandoned was drilled to a depth of 3449' and the other to 1622' without finding oil. An effort made to develop gas in the Highland Development Company well failed on account of not being able to shut off water.

#### Inglewood Field.

A well was drilled in this field by the Bartolo Oil Company to a depth of 4500' and the well plugged and abandoned without developing oil.

#### Newport Field.

Drilling was commenced on two wells in this field during the latter part of the fiscal year. One of these wells, owned by the Standard Oil Company, is located on Section 14, T. 6 S., R. 10 W., S. B. B. & M., and is about 500 feet northwest of the U. S. Collins Well No. 3, which reported oil at a depth of 2525'. The Collins well was never satisfactorily completed on account of water troubles. The other well is owned by the Liberty Petroleum Company and is located near Newport Bay in unsurveyed Section 23, T. 6 S., R. 10 W., S. B. B. & M. This

well is northwest of two abandoned wells which were drilled by the Newport Bay Oil Company. Log of Well No. 1 of this company shows drilling was commenced in November, 1906, and the well drilled to a depth of 2763'. Sands and shales carrying oil were reported at various depths below 1800'. Drilling was commenced on the No. 3 well of this company in May, 1909. This well reported heavy oil at 1850' and was drilled to a depth of 3200'. These wells were both abandoned and according to reports the reason for abandonment was a failure to shut off water. Oil was evidently obtained from these wells, as there is evidence of it in an old sump nearby. Oil-bearing formation has been recently penetrated in Liberty Petroleum Well No. 1 and by the use of modern methods in shutting off water, by which a complete shut off was made, is in a position to make a definite test of the oil-bearing formations which have been penetrated.

### Richfield Field.

This field is situated about 3 miles east of, and takes its name from, the town of Richfield, located on the A. T. & S. F. Ry., about 9 miles east of the city of Fullerton. The field is also about 9 miles southeast of the Olinda field. Drilling was commenced by the Standard Oil Company on their first well on April 6, 1918. This well is located about 1200' from the Santa Fe Railway, being in the unsurveyed Section 36, T. 3 S., R. 9 W., S. B. B. & M. A great deal of interest has been taken in this part of the district since oil-bearing formations were penetrated by this well. The present indications point to the development of a new field. A well drilled by the Yorba Oil Company in 1915, located about a mile northeast of the Standard Oil Company well, reported a number of oil-bearing formations from about 2000' to 3528'. This well was drilled to 3528' and abandoned in 1916 without producing any oil.

The following tabulation is a summary of notices received and decisions rendered by this department, relative to work in these fields, during the fiscal year.

Range- Township- Section-----	Company	New wells				Test of water shut-off	Deepen or redrill				Abandon				
		Orig.		Supp.			Orig.		Supp.		Orig.		Supp.		
		Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
20-2-14	Bartolo Oil					4						1	1	1	1
1-4-13	General Petroleum											1	1		
1-4-13	Standard											1	1		
19-4-12	Union											1	1		
1-4-13	Highland Development			1	2							1			
23-6-10	Liberty Petroleum	1													
14-6-10	Standard	1	1												
36-3-9	Standard	1	1												
	Totals-----	3	2	1	2		4					5	4	1	1

## REPORT

By M. J. KIRWAN, Deputy Supervisor

TO

R. P. McLAUGHLIN,

State Oil and Gas Supervisor.

ON THE

MURPHY-WHITTIER PROPERTY

OF THE

STANDARD OIL COMPANY

SHOWING

**Condition of Wells and Protection of Various Sands from Water.**

This report has been compiled almost entirely from records on file in this office from which drawings were made, and by a study of a peg model showing all wells on the Murphy-Whittier property, together with wells on adjoining properties. Accompanying the report is a diagram showing the various wells in numerical order. The diagram was drawn with an idea of assisting in the study of individual well record and particularly to show the relationship of the three oil zones which, for the purpose of this report, are designated first zone, second zone and third zone. The vertical position of the graphic well logs, in the diagram, was arranged to show the top of the first zone connected by short lines, so as not to form a straight line, allowing the second and third zones, where penetrated by the well, to occupy positions regulated by the actual distance between these zones as shown by the logs.

Maps are given showing relative positions of wells and show by colors and symbols the average amounts of oil and water produced daily by various wells in August, 1917 (see Figs. 10 and 11).

Four cross sections also accompany this report. The cross sections show the following wells: (1) (File No. A-31) Nos. 27, 26, 25, 32, 35, 38 and 13; (2) (File No. A-32) Nos. 36, 25, 43 and 45; (3) (File No. A-33) Nos. 36, 32, 17 and 31; (4) (File No. A-34) Nos. 36, 40, 42, 39, 48, 41 and 14.

In general, the subject has been treated by individual wells, concluding with a general summary and recommendations.

The table, Fig. 12, gives data on individual wells as follows: Well number; total depth drilled; zones penetrated; zones producing; zones protected, unprotected and doubtful; average daily number of barrels of oil and of water and percentage of water produced during August, 1917, and date of completion, when known.

The following explanation of the table is given relative to protection from water of the various zones penetrated:

A zone is considered "protected" by a well when tests demonstrate that water is not entering from either above or below it.

Map accompanying report by  
M. J. KIRWAN  
Deputy Supervisor  
dated Oct. 30, 1917  
— RELATIVE TO —  
STANDARD OIL COMPANY MURPHY WHITTIER PROPERTY  
SECTIONS 26 & 23-T. 2 S. R. 11 W. - S. B. B. & M.  
Whittier Field  
California

Average amounts of WATER produced daily  
by various wells in August 1917

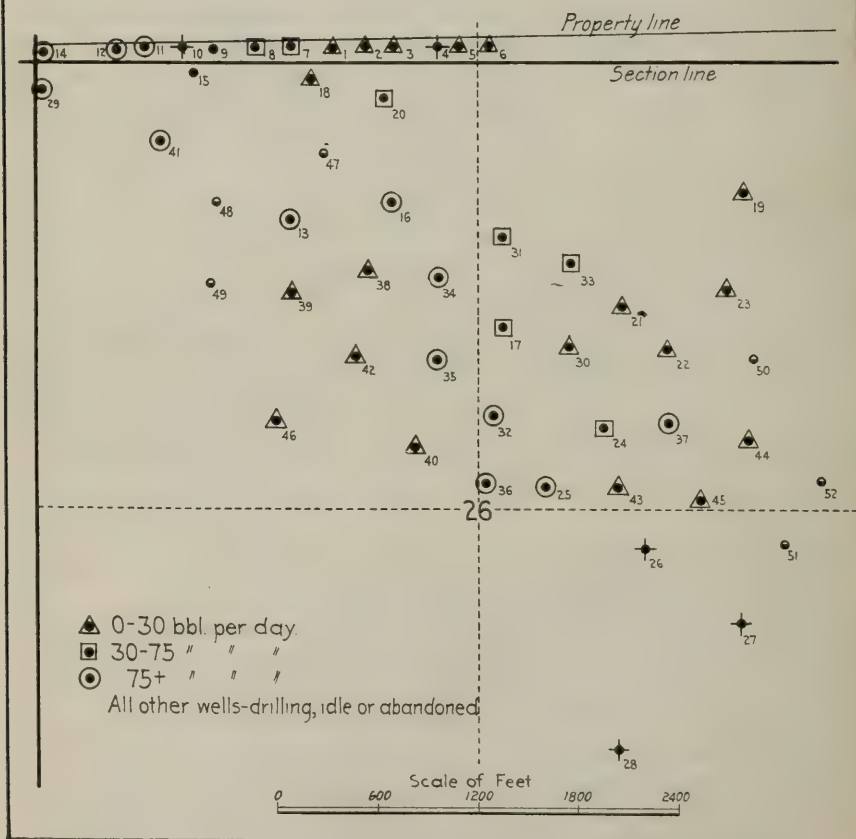


Fig. 10.

Map accompanying report by  
 M. J. KIRWAN  
 Deputy Supervisor  
 dated Oct. 30, 1917  
 ——— RELATIVE TO ———  
 STANDARD OIL COMPANY MURPHY WHITTIER PROPERTY  
 SECTIONS 26 & 23 T 2 S. R. 11 W. S. B. B. & M.  
 Whittier Field  
 California

Average amounts of OIL produced daily by  
 various wells in August 1917

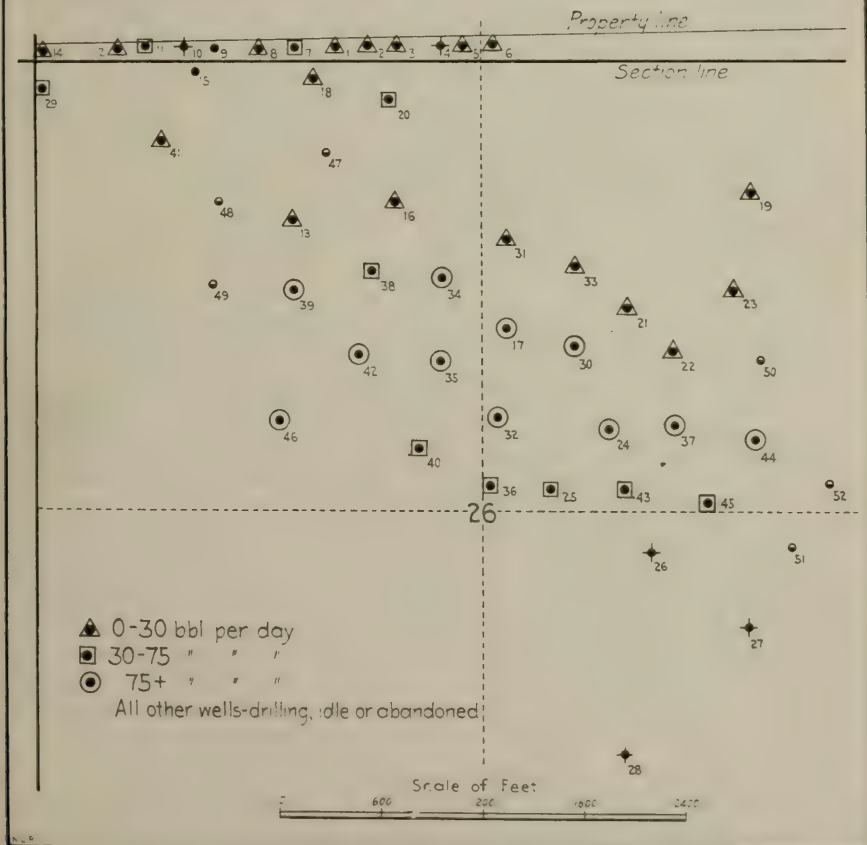


FIG. 11.

Well No.	Total Depth Drilled	FIRST ZONE				SECOND ZONE				THIRD ZONE				AUGUST 1917 Average daily production		% Water	Completed
		Protected	Unprotected	Doubtful	Producing	Protected	Unprotected	Doubtful	Producing	Protected	Unprotected	Doubtful	Producing	Barrels Clean Oil	Barrels Water		
1	1950		X					X				X	X	15	15	50	
2	1940		X					X		X			X	1	0	0	June 1901
3	1950		X					X		X			X	3	0	0	Aug 1901
4	-													*	*		?
5	1800		X					X				X	X	6	12	66	Dec. 1901
6	2305		X					X				X?		4	0	0	
7	2000		X			X				X		X	X	30	74	71	
8	1950		X			X				X		X	X	8	45	85	
9	-													*	*		
10	-													*	*		
11	2500		X			X				X		X	X	48	75	61	
12	2620		X			X				X		X	X	6	114	95	
13	2800		X			X				X		X	X	4	96	96	
14	2660		X			X				X		X	X	20	105	84	
15	2660		X			X				X				*	*		
16	2170		X			X			X	X?		X?	X	28	96	77	June 1907
17	2890		X			X			X?	X		X	X	96	38	28	Sept. 1907
18	2204		X			X						X	X	12	9	43	?
19	2845		X					X		X		X	X	3	0	0	Apr 1908
20	2500		X					X	X?		X		X	30	45	60	?
21	2315		X		X?			X	X					13	8	38	Nov. 1907
22	2221			X	X?	X			X					2	5	71	June 6, 1908
23	2075			X		X			X					18	0	0	Oct 1908
24	2512		X		X?	X			X					96	46	32	July 1909
25	3190		X		X?	X			X		X		X	58	329	85	?
26	5100													*	*		Aug 1913
27	4275													*	*		
28	2910													*	*		
29	2800		X					X				X	X	42	81	66	
30	2832		X			X			X	X		X	X	181	27	12	Dec. 1914
31	2972		X			X			X	X		X	X	28	32	53	Feb. 1915
32	3046		X			X			X	X		X	X	136	174	56	July 1915
33	2687		X			X			X	X		X	X	26	45	63	Sept 1915
34	2910		X			X			X	X		X	X	130	115	47	?
35	2954		X			X			X	X		X	X	160	180	53	Mar 1916
36	3228		X			X			X	X		X	?	57	290	85	Apr 1916
37	2540		X?		X?	X			X					138	148	52	Apr. 1916
38	2518		X			X			X					65	0	0	Sept 1916
39	2099		X			X			X					289	0	0	Aug. 1916
40	2035		X?		X									52	25	32.5	Sept 1916
41	3276		X					X			X		X	16	213	93	Aug. 1917
42	2293			X		X			X					265	0	0	July 1917
43	2097	X			X									68	6	8	Nov 1916
44	2743			X		X			X					113	0	0	May 1917
45	2202	X			X									44	2	4	Jan 1917
46	2407			X		X			X					184	0	0	June 1917
47	2645		X					X		X				Not completed in Aug.			
48	2312			X		X								"	"	"	"
49	1921			X										Drilling			"
50														2489 2450			"

\* Wells not producing.

FIG. 12.

A zone is considered "doubtful" when a shut off has been made below it without afterwards demonstrating that it has been protected.

A zone is considered "unprotected" when water has not been shut off above and tested, or when a well produces from it and makes considerable water.

The term "intermediate water" is herein used as meaning water between the first and second zones, or second and third zones. The position of "intermediate" water in relation to the zones is given in each case where used.

The term "edge water" is herein used as meaning that water indigenous to the down slope portion of an oil stratum which, as the oil is removed from the stratum, follows up the slope and replaces the oil.

The term "top water" in *all* cases means water above the first zone.

The term "bottom water" is not used in this report, except to quote from company records.

Study of the table shows that there are comparatively few wells in which certain zones are known to be protected and that the majority of them are in the "doubtful" class. Probably a number of "doubtful" zones will have to be placed in the "unprotected" class when the presence of "intermediate" water has been established. Possibly some of the zones in wells in the "unprotected" class produce water which enters through the oils and from neighboring wells.

### GEOLOGY.

In general, the structure of this property is a monocline, which is the southward dipping flank of the main Whittier anticline, which is terminated to the north of this property by a fault zone between the Fernando and Puente formations.

It is important to note that the zone of crushing which is in evidence along the fault zone to the north, does not extend into the flanks of the monocline on this property. On the contrary, the structure is a simple monocline, and study of a peg model and cross-sections reveals conformity of underground structure to surface exposures. Three distinct oil zones have been penetrated in drilling on this property. It is worthy to note that zones as reported in log records furnished by the company are fairly uniform. By application of information already obtained these zones may be anticipated at uniform stratigraphic depths in new wells to be drilled in this territory.

The monocline structure is slightly complicated by a flexure, or anticlinal fold in the monocline, the direction of the axis being approximately N. 20° E. and transverse to the strike of the bedding planes of the formations in the center of Section 26, T. 2 S., R. 11 W.

Study of the production reports indicate that this secondary folding introduced into the major structure, probably influences to some extent the disposition of underground storage of oil and water.

On either side of the secondary transverse fold the strike swings toward the direction of the rising axis of the fold.

### SUMMARY OF EVIDENCE AT EACH WELL.

#### Well No. 1.

The log record of this well shows only casing record and depth, and states that light oil was encountered at 1725 ft., being so incomplete that it affords little opportunity to study the possible source of water. (The depth and manner of water shut-off suggests the possible entrance of "top" or "intermediate" water into the various zones.) The depth to which the well was drilled indicates that it penetrated the third zone. Study of the peg model indicates that first zone was encountered at a depth of about 450' and the second zone at a depth of about 950'. The 5½" casing is perforated below 1400 and possibly tamped above this point in order to shut off water. The perforation record indicates that the well produces oil only from the third zone and possibly water from immediately above this zone.

#### Old Well No. 1.

The supposed site of the well is now covered by a blacksmith shop and tanks and is located about 50' south of and between No. 7 and No. 8. Log of this well has not been received. The company probably has no record in their files, as the well was abandoned before the property came into their possession. Probably no protection work for oil sands encountered was done when the well was abandoned.

#### Well No. 2.

Log record very incomplete, giving only casing record and depths between which one oil sand was encountered. Water was shut off by tamping at a depth of 1400' and with a packer set at 900'. This well produces no water. A study of the peg model indicates that the first zone was encountered at a depth of about 450', and the second zone at a depth of about 950'. The log shows rich oil sand from 1800' to 1940'. The lower portion of the well only is perforated.

The depth of the well indicates that it was drilled into the third zone. This well probably produces only from the third zone, showing that this zone is free from water at this well.

#### Well No. 3.

The log record gives only depth of well and casing record, and states that light oil was encountered at 1850'. Perforation record is not

given on the log. The well averages 3 barrels of oil per day and no water. The well was probably drilled into the upper portions of the third zone. The 5½" (oil string) which was tamped possibly excludes water from the first and second zones. Study of perforation records of adjoining wells suggest that probably only the lower portion of this well was perforated.

#### Well No. 4.

The only information given on the log is that the well was abandoned by the Murphy Oil Co. The production records of adjoining wells indicate that this well does not allow much, if any, water to enter the formations from which they are producing.

#### Well No. 5.

The log shows only casing record and depths at which oil was encountered and depth of well. Perforation record is not given. During August the well averaged 6 barrels of oil and 15 barrels of water per day. There is some doubt as to the zones from which the well produces. The well possibly penetrates the third zone.

#### Well No. 6.

The log gives only casing record and depth to which well was drilled. The depth indicates that the third zone was penetrated.

The production record of this well shows that the formations from which the well produces do not carry water. Since perforation record is not given, there is no evidence at hand to show from which depths the well obtains its production.

#### Well No. 7.

The log record is very incomplete. The well has been drilled to about the same relative depth as adjoining wells. The first zone probably has been shut off by the tamping process. The production record shows a serious water condition. This may be caused from deterioration of the water string.

Early drillers in the field state that "Old No. 1," not shown on maps, was drilled between No. 7 and No. 8 and abandoned. If this is so, it may account for the water condition of both No. 7 and No. 8. Water may possibly enter this well from Central Oil Company well No. 36-A, about 100' northwest. The log of Central well shows that the water broke in at 1508' and was shut off at 1550'. The shut-off point in this well was below the shut-off point in Standard No. 7, and possibly let water into the formation from which the latter well produced. There is no evidence at hand to show how this well, Central No. 36-A, was plugged when abandoned in 1905.

**Well No. 8.**

Log record very incomplete. No record of water shut-off. Possibly the 7½" casing landed at a depth of 500' was intended for water string.

This well produces a small amount of oil and considerable water. The source of this water may possibly be abandoned wells No. 9 and No. 10 adjoining, or Central Oil Co. well No. 27-B, located about 100' northwest. No record has been furnished covering work done in January, 1908, in abandoning Central No. 27-B.

(See remarks under well No. 7, relative to "Old No. 1.")

**Well No. 9.**

The log filed fails to give any information other than that "the well was abandoned by the Murphy Oil Co." No doubt the Standard Oil Co. would file additional information on this well in case it was available.

**Well No. 10.**

The log filed fails to give any information except that "the well was abandoned by the Murphy Oil Co."

**Well No. 11.**

The log record, as shown in the diagram, is not very complete. The 7½" (water string) was landed at 980' and probably above the first zone. This well probably penetrates first, second and third zones.

The production record shows a serious water condition. There are a number of possible sources of water entering the well as follows: (1) water entering around water string or through possible deteriorated water string; (2) from well No. 12 adjoining; (3) from abandoned well No. 10 on the east or from wells No. 37-A, 38-A, 39-A of the Central Oil Company which have been abandoned and of which record of work done in abandoning has not been received.

**Well No. 12.**

The well was drilled to 2610' and probably plugged up to 2500'. The oil string is perforated from 2300' to 2500' and from 2010' to 2052'. Water was packed off at 1875'.

Study of the peg model indicates that the well was drilled into the third zone and the first zone was shut off.

This well has a bad water condition and produces about 20 barrels of water to one barrel of oil. The records are incomplete and furnish little information as to the probable cause of this condition. The date of plugging the bottom is not given, but well was probably plugged when drilled, indicating that water trouble was present at that time. It is possible that this well makes its own water or that water may enter from sources pointed out under well No. 11, or from Old No. 13, adjoining on the west.

**Well No. 13.**

The log shows the well was drilled to 2800' and that apparently large quantities of water were encountered in the bottom.

Study of the peg model indicates that 9 $\frac{5}{8}$ " casing which was cemented at 1200', shuts off the upper portion of the first zone. This well has been drilled deeper stratigraphically than any of the adjoining wells, except possibly No. 41.

This well stands practically between well No. 38 and No. 47. Well No. 38 produces clean oil from the second zone and well No. 47 produces clean oil from the third zone. Tests and plugs below second zone in No. 38, demonstrated that water was encountered, establishing that "intermediate" water lies between the second and third zone. This fact may account for some of the water trouble in No. 13. In addition "top" water may not have been shut off and possible "intermediate" water from between the first and second zones may enter the well.

The production of oil obtained from this well is so small and its water condition such as it would seem advisable to either protect the various zones or abandon the well.

**Old Well No. 13.**

Old maps show "Old 13" as having been drilled on the north line, between No. 12 and No. 14. A letter from the company dated September 13, 1917, states that they have no record of this well having been drilled. A former workman in the Whittier field stated that this well produced a large quantity of water and a small amount of oil when pumped. Surface evidence indicates that a well was drilled at this location. Possibly the well was not plugged when abandoned and may be the source of some of the water produced by wells No. 12, 14 and 29.

**Well No. 14.**

This well probably penetrates the three oil zones. The log record does not show the depth at which water was shut off. Possibly the 7 $\frac{1}{2}$ " casing landed at 1900' was intended for a water string, or the 5 $\frac{1}{2}$ " oil string may have been tamped.

Perforation records are not given and there is no definite evidence to show which portions of the well produce. The water condition is serious, possibly due to a combination of causes such as "intermediate" water or "top" water, or entrance of water from neighboring wells.

**Well No. 15.**

The log shows that an oil sand was penetrated between depths of 2220' and 2250' and that the well was drilled to 2660'.

According to monthly production reports, the well has been shut down since July, 1916, during which month it produced 4 days, making an average of 8 barrels of clean oil per day and 95 per cent water.

Study of the peg model indicates that the first and second zones were shut off and the oil sand from 2000' to 2250' is possibly a part of the third zone. The 5½" casing was probably tamped in order to shut off water. This casing apparently was landed below the top of the third zone.

The well in its present condition may be admitting water to zones which are productive in neighboring wells. It would seem advisable to test the well to determine its condition and plug it in order to save the territory.

#### **Well No. 16.**

The log of this well shows that water was shut off at a depth of 1610'. Study of records of adjoining wells and peg model indicate that this shut-off is below the first zone. There is no data at hand to show the method used in shutting off water.

The first zone is probably not protected from water. The record of this well shows that it produced 80 barrels of oil and 100 barrels of water on June 16, 1907. This record suggests the probability of a water bearing formation having been penetrated below the second oil zone. The depth of the well indicates that it entered the top of the third zone or "intermediate" water below the second zone which was encountered and plugged off in adjoining well No. 38.

#### **Old Well No. 16.**

Old maps and surface indications show that a well was drilled east of No. 15. A letter from the company states that they have no record showing this well was drilled. It would seem advisable to make further search for information relative to depth and work in abandoning.

#### **Well No. 17.**

This well was drilled to 2890'. Five and five-eighths inch casing landed at 2740'. The 5½" has only a few holes punched in it. The 4½" liner was well perforated. Water shut off at 2060'.

Study of peg model indicates that shut-off point in this well is below the first zone and that the well penetrated the third zone. The date of completion suggests that the "tamping" method was used to shut off water. Water which enters this well may come through the third zone. Study of adjoining well records indicate the possibility of entrance of water through the perforation in the 5½" casing and that the source of the water probably is above the third zone.

#### **Old Well No. 17.**

Old maps and surface indications show that this well was drilled east of "Old" No. 16 and west of No. 18.

The company stated that they have no evidence of this well as having been drilled. Perhaps it would be well for them to try and secure

some information relative to existence, depth, work in abandoning, from former employees on the property, providing they are in the district.

#### Well No. 18.

Study of peg model indicates that the 52" casing was landed immediately above the top of the third zone and that this zone was penetrated by the well. The first and second zones were shut off. The production of the well amounts to nearly one-half water. However, the amount of water being relatively small does not indicate a serious water condition. Record of perforation is not given in the log. The production is probably obtained from the third zone.

#### Well No. 19.

Study of records at hand indicates that the oil sand encountered from 1300' to 1350' is a part of the second zone, and that the showing of oil encountered at 2497' is possibly a part of the third zone. The second zone was probably shut off with the 72" casing and probably not protected. The greater portion of the second zone is probably behind the 58" casing and also probably unprotected.

The log shows that water was encountered at the bottom. Record of depth and manner of water shut-off is not given. Possibly water was tamped off around the 52" casing, beginning at the top of the perforations. The lower 400' of the oil string is perforated. The production record shows that the well averaged only 3 barrels of oil per day and no water, during August, 1917. The records do not show whether water encountered at the bottom of the well was plugged off or exhausted.

#### Old Well No. 19.

The well is located between No. 18 and No. 20. A letter from the company states that they have no log or history and that they believe the well is very shallow.

#### Well No. 20.

The log of this well shows only casing record and depth of well. Study of the peg model indicates that the first zone was encountered at a depth of about 700' and the second zone at about 1200' and the top of the third zone at about 1900'. The first zone and upper part of the second zone were probably shut off with the 92" casing. The well probably produces from the third zone and a part of the second. The depth and manner in which the well was cased suggest the possible entrance of "intermediate" water from between the second and third zones or water from above these zones.

The absence of formation record would make it difficult to suggest remedial work or for the company to correct the trouble without considerable expense in plugging and testing. No doubt records similar to

the one kept at this well are largely responsible for the former owners doing especially poor work in the matter of handling the water problem in the wells which they drilled.

#### Well No. 21.

Study of the peg model indicates that the first zone was encountered at a depth of about 1350'. The shut-off point in this well is below the first zone and probably immediately above the second zone. The well probably produces from the second zone only. As shown on the accompanying diagram, the log is very incomplete. The typewritten copy of the log does not definitely show the depth to which the well was drilled, or give a record of the perforations. The well produces only a small amount of oil and water.

#### Well No. 22.

The log shows that this well was drilled to 2221', and gives no casing record below a depth of 1540', at which depth 5½" casing was landed.

Study of the peg model indicates that the first zone was encountered at a depth of about 1450'. The log does not give a record of formations penetrated above a depth of 1800'. The well averages 2 barrels of oil and 5 barrels of water per day. This production is probably obtained from the second zone. More complete casing record is very desirable, for, if the formations below the bottom of the 5½" casing (landed at 1540') are not shut off, it would indicate that the formations between the first and second zones do not carry water at this well.

#### Well No. 23.

Study of the peg model indicates that the first zone was penetrated at a depth of about 1400' and that the well was not drilled below the second zone.

The log record shows that the well was sand-tamped for nearly 300' above perforation. Tamping was probably started at a depth of 1645', shutting off water below the first zone. The production record shows that the second zone is free from water at this well.

#### Well No. 24.

Drilling was commenced July, 1908, and completed July, 1909. Tamping to shut off water was started at 2090'. Several tons of sand was tamped behind the 5½" casing. This operation shut off the first zone probably without protection. The well probably produces from the second zone.

Study of log record and production reports give little evidence regarding the probable source of water entering the well. The method used in shutting off water suggests the possibility that all water was not effectually excluded. The log does not give a record of the formations

penetrated above a depth of 2100'. Study of the peg model shows that the first zone was probably encountered at a depth of about 1625'.

The top of the second zone probably begins at 2100', where "oil" is reported.

The depth of the well suggests the possibility of entrance of water from near the bottom. This water would correspond to "intermediate" water between the second and third zone. There is no data at hand to show the exact depth at which water was encountered below the second zone, in other wells, and by which the depth to possible "intermediate" water may be compared.

#### Well No. 25.

Study of the log record and peg model indicates that the first zone was penetrated at 1767'. Nine and five-eighths inch casing was cemented with 10 tons of cement above the first zone. The log does not state if an effective shut-off was made. The well penetrates and probably produces from the three zones. This well produces about 6 barrels of water to one barrel of oil. The water condition is serious and work to remedy this condition should be started in the near future. Probable "intermediate" water between the second and third zones may be the cause of most of the trouble. It would seem advisable to locate the source of the water by plugging between these zones in order that each of them may be properly protected.

#### Well No. 26.

This well was drilled to a depth of 5100', penetrating and logging the three oil zones.

The well was plugged at a critical place (from 2892' to 2462') with pipe cutting and gravel on inside of the 7 $\frac{3}{8}$ " casing. Plugging in this manner and with material used could not reasonably be expected to protect oil bearing formation between these depths. The cement plug from 2462' to 2412' probably prevents the passage of water on the *inside* of the 7 $\frac{3}{8}$ " casing between these depths. Gravel from 2412' to 2388' was probably used to merely fill up this space. Plugging done with pipe cuttings and gravel from 2345' to 2310' probably is of no particular value as *oil sand* is recorded between these depths. The log shows oil sand where the next cement plug was put in, except upper 10' of the plug is in sandy shale, providing the plug is not inside of the casing.

Particular attention is hereby called to the manner of plugging wells on the inside of casing, even though in some cases it may be perforated, in which passage of water may not be prevented along the outside of the casing.

Work at this well was completed by Standard Oil Company May 2, 1914.

The log, or history, does not give a record of the shooting done in loosening the upper portion of 7½" and 9½" casings. Recent developments in adjoining wells No. 43 and 45 show conclusively that the first zone is productive and free from water at these wells. The history of well No. 26 shows that the various oil zones were probably not adequately protected from water when abandoned and water may possibly enter the various oil zones penetrated by this well.

#### Well No. 27.

This well was drilled to 4275' and abandoned by the Murphy Oil Co. Sands carrying oil are reported in the log. These sands may represent the first zone penetrated by other wells on the property. Record of work done in abandoning has not been furnished. Probably this information was not available to the Standard Oil Company at the time they purchased the property. This well is about 700' distant from other wells, and in line of present development. Future developments may show that water is entering oil sands at this well.

#### Well No. 28.

The log states that this well was drilled by the Murphy Oil Company and was being abandoned at the time the property was taken over by the Standard Oil Company. Abandonment work was completed in April, 1914, by the present owners. The reason given for abandonment is that it was a "dry" hole.

The well was probably drilled deep enough to encounter formations corresponding to the first zone. There are no means at this time for determining whether possible productive formations were encountered. Future development of the territory may furnish this information.

#### Well No. 29.

Study of the peg model indicates that this well was drilled into the third zone. The log shows that 8¼" casing was cemented at 2389', above "dark, sandy shale, showing a little oil." Although the log gives a record of the formations passed through, there is not much evidence to definitely show the depth at which the various zones were encountered. The well is located in the northwest corner of Section 26, and logs of adjoining wells give but little information for the establishment of correlation with formations penetrated by them.

The log does not show what tests, if any, were made to determine the effectiveness of the shut off with 8¼" casing. There is no information at hand to show that oil bearing formations above the shut off point, and from which adjoining wells may be producing, are protected from water. Possibly water from "Old" No. 13 may enter this well.

**Well No. 30.**

This well was completed in December, 1914.

Study of the peg model and cross sections shows that the first zone was encountered at 1500'. This zone was shut off with 10" casing cemented at 2021' with 7 tons of cement. No definite evidence to show that this zone has been protected is given in records received from the company.

The log gives no data relative to tests made to determine the effectiveness of water shut off with the 10" casing.

The well produces from the second and third zones. This well averaged 27 barrels of water per day during August. This amount is less than produced by the average well penetrating and producing from more than one zone. The following production record is taken from the monthly production reports received by the department from the company:

Month	Barrels oil	Per cent water
1916-January	8,125	12
February	5,743	12
March	4,909	12
April	5,684	12
May	7,626	12
June	7,290	12
July	7,003	5
August	6,975	4.7
September	6,480	5
October	6,975	49.5
November	6,750	9.7
December	7,006	9.8
1917-January	6,240	14.4
February	5,492	23.2
March	5,779	19.9
April	5,619	18.6
May	5,813	18
June	5,535	16
July	5,748	13
August	5,667	13

The log shows that the oil string has been perforated opposite all of the sands reported below the top of the first zone.

The water produced possibly comes from sands between the second and third zones.

**Well No. 31.**

This well was completed February 5, 1915.

There is no evidence at hand to show that the first zone has been protected from water. The shut-off point in the well is below the first zone and above the second zone. The well was drilled into the third zone. Assuming that the shut-off is effective (cemented with 7 tons) then the water which is produced probably enters the well through the second or third zones, or from between these zones

**Well No. 32.**

The shut-off point is below the first zone. The well was drilled into the third zone. Records from the company show that the well was plugged with cement and lathe turnings from 3046' to 2970' and failed to shut off water. Test of water shut-off witnessed by this department on September 13th, 1915, showed that water was not shut off and the following recommendation was made:

"This well may be pumped for 30 days from date to demonstrate if water is shut off. At the option of the company, during this time, a new plug may be put in or the water string tested."

Additional plugging has not been done to date.

The log shows that 8 $\frac{1}{4}$ " casing landed at 2957' above the point to which the well was plugged. Evidently plugging was done in the *formation*, below the casing. The records do not show if any sidetracked casing was left in the well below a depth of 2957' which might act as a conductor of water. The well was plugged at the bottom in sand. The 10" casing which was cemented with 10 tons of cement probably prevents the downward passage of water below a depth of 2139'.

Probable "intermediate" water from between the second and third zone may be entering this well.

**Well No. 33.**

Study of the peg model and log record indicates that the 12 $\frac{1}{2}$ " casing was cemented below the first zone. The log gives no record as to the effectiveness of the shut off with the casing.

The 10" casing was cemented above the second zone. Records filed do not show manner or result of test of water shut off. The well was drilled into the third zone and produces from both second and third zones and averages nearly two barrels of water to one barrel of oil. Probable "intermediate" water between the second and third zones may be entering the well.

**Well No. 34.**

The shut-off point is below the first zone and above the second zone. Record of results of test of shut off are not shown on the log. The well averaged 130 barrels of oil and 115 barrels of water per day during August. The source of water in this well probably is the same as other "third zone" wells in the vicinity. "intermediate" water or possibly water entering the well through the second or third zone.

**Well No. 35.**

Drilling was commenced August 24, 1915.

The first zone was shut off, the shut-off point being above the second zone. The test of shut off with 10" casing was witnessed and approved by a member of this department.

The well was drilled into the third zone and completed March 22, 1916; however, the March production report shows it producing 31 days

during this month. It is important that the production of oil and water be recorded immediately after the completion of a well. The production report showed the amount of oil produced but *not* the amount or percentage of water until June, 1916, when the report showed the well making 2.4 per cent water and, the month following, as making 45 per cent water. At the request of this department, the company checked the June production with their field records and found that the well averaged 254 barrels of oil and 180 barrels of water per day, during June, 1916.

Probably the 10" casing is still preventing the passage of water below the cementing point (2208'), indicating that the source is from the second or third zone or "intermediate" water from between them.

During August, 1917, this well produced considerably more water than oil.

### Well No. 36.

Drilling was commenced October 18, 1915; 12½" casing cemented at 1720', above the first zone, but failed to shut off water. Notice of test of water shut-off was not filed and test was not witnessed by this department. Drilling was continued and 10" casing cemented at a depth of 2351', *below* the first zone. The first test made by the company after cementing, showed that water was not shut off. The 10" casing was re-cemented with tubing by pumping in 1½ tons of cement. Test of water shut-off witnessed by a member of the department showed that water was not passing to lower levels in the well. The well was drilled into the third zone. The log record states that "bottom" water was encountered somewhere between depths of 2351' (water shut-off point) and 3228' (bottom of well). The well was pumped from April 15 to May 7, 1916, and according to the record made a large amount of water with a slight showing of oil. Production of this well was not shown on production reports until June, 1916. Following is the record given. The barrels of water was computed by this department from data on the report.

Month	Bbl. of clean oil	Bbl. of water	Per cent water	Number of days produced	Remarks
1916—June	618			13	
July					Shutting off water.
August	1,080	9,720	90	20	
September	1,378	12,402	90	30	
October					Well not shown.
November					Well not shown.
December	980	1,728	61	9	Production report shows well producing 31 days.
1917—January					Not shown.
February					Shutting off water.
March					Shutting off water.
April	890	2,943	78	12	
May	2,085	3,707	64	31	
June	1,637	7,401	82	28	
July	1,524	6,497	81	29	
August	1,532	8,681	85	30	
Totals	11,664	53,079			

The various plugging and testing operations which were carried on at this well from April, 1916, to April, 1917, showed that water was entering the well somewhere below shoe of the 10" casing. The matter of plugging and testing was not taken up with this department. At present the well produces about six times as much water as oil and possibly allows a large quantity of water to enter both the second and third oil zones.

In view of the amount of work done at this well and its serious water condition, it would seem advisable to clean out or redrill, if necessary, to a depth of about 3110'; shoot and plug with cement in the *formation* between the following depths: 3090' and 3110'; 2995' and 3015'; 2880' and 2900'; 2650' and 2670'. Each cement plug put in should be allowed to stand at least 24 hours and a determination made that cement has set properly before doing further work. The space between the cement plugs should be filled with clay or cement. Test should be made, pumping preferably, after each cement plug has been put in. While the record shows that *all* casing above a depth of 2529' has been withdrawn from the well, it would seem advisable to shoot between depths indicated above in order to shoot together one or more open holes that possibly have been sidetracked during the various plugging, replugging and redrilling operations.

The failure to shut off water in this well after a year's work should be sufficient evidence to prove that it is not advisable to drill wells *below* the second zone until such time as the water situation can be effectively handled.

#### Well No. 37.

Study of the peg model indicates that the horizon of the first zone may begin at 1600', where sandy shale showing oil was encountered, or with the "sandy shale showing oil" encountered at a depth of 1816'. This latter shale is reported as 33' in thickness and has been shut off with 10" casing cemented at 1874'. Test of water shut-off witnessed by this department shows the balance of the first zone was protected from "top" water. The well was drilled into the second zone.

Following is a record of the early production of the well. The number of barrels of water shown was computed by this department.

	Month	Bbl. of clean oil	Bbl. of water	Per cent water	Number of days produced
1916	April	2,205	490	18.4	7
	May	9,083	2,170	19.3	31
	June	9,180	4,440	32.8	30
	July	9,637	4,466	31.6	31
	August	9,300	5,700	38.0	31
	September	7,488	4,589	38.0	30
	October	8,335	5,100	38.0	31
	November	7,440	6,463	46.5	30
	December	6,975	6,092	46.5	31
1917	January	5,760	7,024	54.9	30
	February	4,643	5,450	54.0	24
	March	6,114	7,323	54.5	29
	April	4,965	6,717	57.5	30
	May	4,499	6,474	59.0	31
	June	4,407	6,341	59.0	30
	July	4,128	4,845	54.0	30
	August	4,226	4,580	52.0	31
	Totals	108,415	88,226		

The production record for April, May and June, 1916, was taken from a report from the company and not from monthly production reports, which apparently have typographical errors as to the number of days produced and percentage of water.

There is apparently a typographical error in the log, which shows the well completed, *September*, 1916, as production report is shown for April of same year.

The 8 $\frac{1}{4}$ " casing (oil string) is landed about the center of the second zone and is *not* perforated. The present 6 $\frac{1}{4}$ " oil string is perforated through the second zone only.

It would seem advisable at this time to make an effort to locate the source of water entering the well and carry out necessary remedial work in order to protect both the first and second zone from water. Study of production of wells in the neighborhood show that clean oil may be produced from either the first or the second zone, individually, as follows: first zone, Wells No. 43, No. 45; second zone, No. 44.

Study of the record of this well indicates that the source of water is local and probably is "intermediate" water from between the first and second zones or possibly from below the second zone.

#### Well No. 38.

Drilling was commenced December 21, 1915. The company proposed to shut off water at a depth of about 2050', estimating that producing oil sand should be encountered at 2100'. This proposal received the approval of this department.

The first zone was encountered at a depth of 1420'. No provision was made by the company to protect this zone; 12½" casing was carried through it and "landed" at a depth of 1617'. Water was shut off in the well immediately above the top of the second zone and test approved by this department. The well was drilled 540' below the top of the second zone, entering water-bearing formations and possibly the top of the third zone. After drilling was completed, the well produced at the rate of 500 barrels of *water* per day. The record indicates that the oil string was withdrawn and the bottom of the well plugged up to 2070' with cement, brick, rope and gravel.

The work at this well definitely showed two things: (1) that water-bearing formations are present below the second zone; (2) that the second zone does *not* carry water at this well. The records do not show whether or not the hole was plugged from 2518' to 2070' in one operation. This leaves the question of exact depth of source of water undecided except that it is between limits of 2518' and 2070'.

#### Well No. 39.

Drilling was commenced February 22, 1916. It is interesting to note at this time that the company estimated in their notice of intention to commence drilling, that water should be shut off at a depth of 2100', and that approval was given by this department to shut off at this depth, also that the well was completed at a depth of 2099'.

No provision was made by the company to protect the first zone from water as 12½" casing was "landed" below this zone. Water was shut off immediately above the second zone and well was completed July 21, 1916, making an average of 330 barrels of clean oil per day and *no* water, proving that the the second zone is very productive and free from water. The present daily average of this well is 289 barrels of clean oil and *no* water.

#### Well No. 40.

Drilling was commenced April 22, 1916. The company estimated that productive oil sand would be encountered at a depth of 3000' and proposed to shut off water at a depth of 2200', or 800' above where oil sand was expected. The log shows that the well was completed at a depth of 2035', or nearly 1000' above where it was estimated the *top* of oil sand should be encountered.

Estimates of this kind are confusing and are of no value to this department. The company was advised that the local representative of the department could not be present at the test and requested them to test the well themselves and file written report. This was done and test approved in our decision No. C-89, dated September 27, 1916.

The well was completed August 29, 1916. Production report for September, 1916, shows that the well was "brought in" making a daily

average of 193 barrels of clean oil and 28 per cent water during 17 days in this month.

This well has been drilled into the first zone only. The production shows that the first zone is capable of producing a sufficient amount of oil to warrant definite protection from water in this and other wells penetrating this zone. Study of the production record indicates that water may not be completely shut off or that the first zone carries water at this location. This water may possibly enter the well from adjoining wells, numbers 25, 32, 35 and 36, all of which are "third zone" wells, completed and producing large amounts of water at the time this well made its initial production.

The log shows gravel from 1960' to 1995' and shale from 1995' to 2035'. The water condition of the well may possibly be improved by plugging from 2035' up to about 1950'.

Following is production taken from monthly reports. The data under "Barrels of water" were computed by this department.

Month	Bbls. of clean oil	Bbls. of water	Water, per cent	Number of days produced
1916—September .....	3,281	1,275	28.0	17
October .....	2,147	835	28.6	31
November .....	2,331	1,480	39.0	30
December .....	2,227	475	17.6	31
1917—January .....	2,116	1,380	39.5	23
February .....	3,416	1,569	31.5	28
March .....	1,455	1,235	38.3	22
April .....	3,871	955	19.4	30
May .....	3,716	815	18.0	29
June .....	2,962	740	20.0	28
July .....	1,592	715	31.0	20
August .....	1,047	492	32.0	20
Totals .....	30,631	11,975		

#### Well No. 41.

Notice of intention to commence drilling was received April 20, 1916.

This well is located near the northwest corner of Section 26, and there is some doubt as to the exact depths at which the various zones were encountered. Study of the peg model indicates that the first zone was encountered at a depth of 1145'; at which depth first oil-bearing formations are recorded in the log.

Ten-inch casing was cemented at 1916', or 16' below the top of the oil sand encountered at a depth of 1900'. The results of test of water shut-off showed that water was prevented from descending to lower level in the well. The shut-off point was below the first zone and probably into the second zone. Records from the company state that the well was drilled to 2103' and 8½" perforated casing set at 2087', and well pumped 3 days, exhausting drilling water and oil. The 8½"

casing was carried to 2851'. Bailing tests showed that the well was making water. At this depth, cement was pumped through the perforations of the 8 $\frac{1}{4}$ " casing; failing, however, to shut off this water. The 6 $\frac{1}{4}$ " was put in and the well deepened to 3048'. Hole was bridged back to 2882', at which depth the 6 $\frac{1}{4}$ " casing was cemented, but failed to shut off water. With the well in this condition, the company proposed to put in the 4 $\frac{1}{2}$ " casing, make pumping test and deepen. Approval was given *only* to clean out to 3048' and test by pumping. (See our Decision No. CC-282 of May 26, 1917.) This decision states that further recommendations would be made after the well had been tested by pumping. In answer to a request for information, the following letter, dated October 24, 1917, was received from the company:

"In reply to work done in M-W Well No. 41, since your Decision No. CC-282 of May 26, 1917:

On same date Decision CC-282 was sent to company, production was discontinued. Tubing and rods were pulled out the day following and cleaning out, underreaming and drilling operations followed throughout balance of May, all of June and July and part of August. Hole was deepened from 3048 to 3276 ft. and the well was finished up with 4 $\frac{1}{4}$ " casing, landed at 3258 ft. Started putting in the 4 $\frac{1}{4}$ " May 29th, and landed same August 4th. The 6 $\frac{1}{4}$ " casing was not disturbed. Put well to pumping August 6th. Made water 6th and 7th. From 8th to 12th, 'Pumping water, shows a little oil.' August 13th, 'Water, shows a little more oil.' Since August 13th, has been reported in production column regularly. The August production report shows 93 per cent water. September 94 per cent water.

Will have log in duplicate on regular form at early date."

The well produced 16 days during August, 1917, and made a daily average production of 16 barrels of clean oil and 214 barrels of water.

The outstanding feature of work at this well is that the first zone was shut off and probably not protected from water. The second zone protected from water above it. The test of 3 days was not sufficient to adequately demonstrate the productiveness of this zone. However, it did show that the second zone does not carry water at this well. Study of peg model and log records indicates that the top of the third zone probably begins at a depth of 2500' and that the upper portion of this zone has been shut off with 6 $\frac{1}{4}$ " casing cemented at 2882'.

The company did not submit a proposal or receive approval of this department to cement perforated 8 $\frac{1}{4}$ " casing at a depth of 2851', below the second zone. Notice of test of water shut-off was not received. The results of tests made by the company showed that this casing failed to shut off water. Study of the results of this test indicates that "intermediate" water was encountered between the second and third zones,

or that possibly the upper portion of the third zone carries water. A proposal was not received to cement the 6½" casing at 2882', nor notice of test of water shut off when the cement job was tested.

The letter of October 24 from the company, quoted above, shows that our decision No. CC-282 was ignored and the well deepened from 2048' to 3276' with water not shut off. Work of this kind only serves to complicate matters.

Recent developments at adjoining Well No. 47, which produces clean oil from the third zone, show the necessity of tests to determine the source of water entering the well, and that repair work is necessary to protect the various zones from water.

#### Well No. 42.

Notice of intention to commence drilling was received April 20, 1916. The company estimated that productive oil sand should be encountered at a depth of about 2900'. Water was shut off with 10" casing at 1587' and the top of the first zone encountered at 1600'. The well was drilled 100' into the first zone and produced with the following results, according to the monthly production reports:

Year and month	Barrels of clean oil	Percentage of water	Gravity	Number of days produced
1916 November .....	756	Not given	13.1	12
December .....	425	Not given	12.5	25
1917 January .....	396	Not given	12.5	9
February .....	135	Not given	12.3	3
March .....	612	Not given	13.5	20

On May 1, 1917, this department approved proposal from company to deepen and cement 8½" casing below the first zone and above the second zone. The company stated that this casing would be cemented to prevent water that might be encountered from entering either the upper (first zone) or lower sand (second zone), and to keep heavy oil out of second zone. Accordingly 8½" was cemented at 2111'. After receiving approval of test of water shut off, the well was drilled to a depth of 2293' and the well completed in the second zone.

The results obtained show that first zone was free from water at this well and yielded an average production of 34 barrels of oil per day for days which the well was pumped, although it appears to have been difficult to operate the well on account of sand trouble. Probably the well would have produced more oil if the first zone was penetrated to a greater depth, as the deepening record showed that oil sand continued for 34 feet below the depth at which the well was tested. Records of this department do not show that tests were made to establish the presence or

absence of water bearing formations between the first and second zones. At present the well produces an average of 265 barrels of oil per day and no water from the second zone.

#### Well No. 43.

Drilling was commenced August 17, 1916, and completed November 17, same year. This well penetrates and produces from the first zone *only*.

Production record is as follows:

Year and month	Barrels of clean oil	Percentage of water	Gravity	Number of days produced
1916—November .....	612	Not given	13.0	4
December .....	6,397	22.8	14.9	31
1917—January .....	5,549	7.7	14.9	31
February .....	3,947	Not given	14.9	28
March .....	3,366	12.4	11.4	28
April .....	2,850	12.8	11.1	28
May .....	2,724	14.0	11.0	31
June .....	2,298	8.3	12.0	30
July .....	3,300	7.9	13.0	31
August .....	2,110	8.0	11.0	31
Total .....	32,162			

There is an error in the monthly production reports for this well as follows: the percentage for June is shown as 83. The percentage for July is shown as 79, and should be 7.9. This has been confirmed by a letter from the company.

The production of oil obtained from the first zone at this well is sufficient to warrant its protection from water in future wells drilled on the property.

#### Well No. 44.

Notice of intention to commence drilling was received June 6, 1916. Approved proposed depth of water shut-off. "Brown shale showing oil" was penetrated between depths of 1885' and 1905'. Study of the peg model indicates that the first zone was probably encountered at a depth of 2045'; however, there is some question as to whether or not the top "Brown shale showing a little oil" should not be taken as the top of this zone. Ten inch casing was cemented at 2042' and the well drilled 38' ahead of the shoe of this casing and apparently bailed dry. Test of water shut-off witnessed December 12, 1916, showed 250' of fluid in the hole, mostly water. Formation had filled 6' up into the water string when this test was witnessed. Recommended cleaning out and that further bailing tests be made. A report from the company, dated December 20, states that subsequent bailing tests were made and concluded by allowing the well to stand 24 hours, when two bailers of oil and no water came in. However, the well had *filled up* 220' with



ASSOCIATED OIL CO  
"Morganti"

ASSOCIATED OIL CO  
"Arellanes"

DOHENY PAC PET CO

DOHENY PAC PET CO  
"Saladino"

DOHENY PAC PET CO  
"Lease N21"

DOHENY PAC PET CO  
"Lease N22"

UNION OIL CO.  
"Escalante"

ASSOCIATED OIL CO  
"S.P. Lease"

S.P. Co. (Fuel Oil Dept.)

CONTOUR MAP  
— of portion of —  
**CASMALIA OIL FIELD**  
— Showing —  
BOTTOM OF BLUE OR GRAY SHALE  
— and —  
TOP OF HARD BROWN SHALE  
Contour Interval 25 ft.

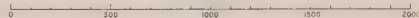
— BY —  
H. W. BELL  
November 1916

CALIFORNIA STATE MINING BUREAU  
DEPARTMENT OF PETROLEUM & GAS  
FLETCHER HAMILTON R. PHILLIPS  
STATE MINERALOGIST STATE OIL & GAS SUPERVISOR



ASSOCIATED OIL CO  
"Ord-Peshine"

Scale of feet



mud and sand when this test was made. In this condition the well stood bailed dry for an additional 48 hours.

Test of water shut-off was approved after this test had been completed. The well was then deepened to 2701' (into the second zone) and pumped from January 6 to February 15, 1917, averaging about 10 barrels of oil per day. During this time trouble was experienced with heaving sand and considerable water had to be run in when cleaning out. The water condition of the well was not definitely determined, although the production reports show that the well averaged about 50 per cent water while pumping.

The well was bridged from 2620' to 2560' and 8½" casing cemented at the latter depth. Test of water shut-off was witnessed on April 9, 1916, and the following decision rendered:

"Data at hand indicates that the 8½" casing which was cemented at a depth of 2560' shuts off formations which are productive in adjoining wells, and damage from water may be ensuing. This casing was cemented without the approval or knowledge of this department. The test indicates that possible water above a depth of 2560' is prevented from passing to lower levels in the well. I recommend that the company test the well by pumping or bailing above a depth of 2701', pending further recommendations."

The well was deepened from 2701' to 2743' and at present is producing from the second zone. During August of this year the well averaged 113 barrels of oil per day and *no water*, showing that the second zone is free from water and that water evidently was present between the first and second zones.

Work at this well demonstrated the failure to produce clean oil from both the first and second zones simultaneously.

#### Well No. 45.

Drilling was started October 13, 1916, and the well completed January 24, 1917. This department approved proposed estimated depth for shutting off water. Water was shut off above the first zone. The well was drilled into the first zone *only*, and during August, 1917, averaged 44 barrels of oil and 2 barrels of water, daily.

Probably all of the first zone has not been penetrated by the well and the production may possibly be increased by deepening. In case the company decides to deepen, it would be well to do so in stages of about 50', in order to locate possible "intermediate" water below the first zone and above the second zone. The production obtained demonstrates that the portion of the first zone entered is practically free from water at this well.

APPROXIMATE  
BOUNDARIES

APPROXIMATE  
BOUNDARIES

APPROXIMATE  
BOUNDARIES

APPROXIMATE  
BOUNDARIES

CONTOUR MAP  
of the  
**CASIMIA OIL FIELD**  
Showing  
**BOTTOM OF BLUE OR GRAY SHALE**  
and  
**TOP OF HARD BROWN SHALE**  
Contour Interval, 25 ft.

U. S. GEOLOGICAL SURVEY  
CALIFORNIA STATE MINING BUREAU  
DIVISION OF PETROLEUM  
SAN FRANCISCO, CALIF.



mud and sand when this test was made. In this condition the well stood bailed dry for an additional 48 hours.

Test of water shut-off was approved after this test had been completed. The well was then deepened to 2701' (into the second zone) and pumped from January 6 to February 15, 1917, averaging about 10 barrels of oil per day. During this time trouble was experienced with heaving sand and considerable water had to be run in when cleaning out. The water condition of the well was not definitely determined, although the production reports show that the well averaged about 50 per cent water while pumping.

The well was bridged from 2620' to 2560' and 8½" casing cemented at the latter depth. Test of water shut-off was witnessed on April 9, 1916, and the following decision rendered:

"Data at hand indicates that the 8½" casing which was cemented at a depth of 2560' shuts off formations which are productive in adjoining wells, and damage from water may be ensuing. This casing was cemented without the approval or knowledge of this department. The test indicates that possible water above a depth of 2560' is prevented from passing to lower levels in the well. I recommend that the company test the well by pumping or bailing above a depth of 2701', pending further recommendations."

The well was deepened from 2701' to 2743' and at present is producing from the second zone. During August of this year the well averaged 113 barrels of oil per day and *no water*, showing that the second zone is free from water and that water evidently was present between the first and second zones.

Work at this well demonstrated the failure to produce clean oil from both the first and second zones simultaneously.

#### Well No. 45.

Drilling was started October 13, 1916, and the well completed January 24, 1917. This department approved proposed estimated depth for shutting off water. Water was shut off above the first zone. The well was drilled into the first zone *only*, and during August, 1917, averaged 44 barrels of oil and 2 barrels of water, daily.

Probably all of the first zone has not been penetrated by the well and the production may possibly be increased by deepening. In case the company decides to deepen, it would be well to do so in stages of about 50', in order to locate possible "intermediate" water below the first zone and above the second zone. The production obtained demonstrates that the portion of the first zone entered is practically free from water at this well.

**Well No. 46.**

Drilling was started December 21, 1916.

The company proposed to shut off water at a depth of about 1600', and estimated that productive oil sand should be encountered at a depth of about 1700'. This department recommended that company shut off water at about 2000'. The following letter, dated January 3, 1917, was received from the company in reply to this decision:

"Kindly refer to your letter to me under date of December 27th, and your report on proposed operations, dated December 29th, No. CC-183, both relative to the drilling of M-W No. 46.

You state that you think it advisable to shut off water at 2000 feet. We know there is a heavy oil sand above this point at about 1700 ft. and therefore would recommend shutting the water off at about 1600 ft., as stated in our notice of December 13th. We would endeavor to shut this water off with the 10" casing and test out the heavy oil sand at 1700 feet. If we were unsuccessful in shutting off the water, and the quantity of oil obtained was not sufficient to warrant us continuing producing from this sand, we would shut off the water at 2000 ft. with 8½" casing and complete the well in the lower sand with 6¼" casing.

Kindly advise me as soon as possible, your recommendations in this matter."

This department replied on January 8, 1917, as follows:

"Yours of January 3d relative to Murphy-Whittier No. 46 to hand. Note what you have to say about heavy oil at 1700 ft. If you think this is worth testing out, it will be all right to shut off water at about 1600 ft. and make the test, but I think it is very bad policy to change your shut-off point back to a higher level, and would not recommend your drilling into the lower sand until you have shut off with the 8½" at about 2000 ft. It is my belief that the present bad condition of this property is largely due to the hit-and-miss policy which was formerly followed in this regard."

Twelve and one-half inch casing was cemented at 1534' but failed to shut off water. This department was not notified to witness this test. Study of the peg model indicates that the first zone was encountered at a depth of 1556' and continued to a depth of 1836'. Ten inch casing was cemented at a depth of 2227', with 13½ tons of cement on May 28, 1917, and test of shut-off showed that water was not passing to lower levels in the well. The second zone was encountered at a depth of 2212'.

Study of records filed by the company indicates that the first zone was not tested to determine its productiveness. Possibly this was due to the fact that water above this zone was not effectively shut off. The attention of the company was called to the unprotected condition of

the first zone. The theory was advanced by the company that cement behind the 10" casing reached up to the bottom of the 12½" casing and protected the first zone from water. The correctness of this theory, however, was not demonstrated and damage to the first zone may be ensuing. Adjoining Well No. 40 was averaging 120 barrels of oil per day from the first zone, at the time the first zone was shut off in Well No. 46.

Following is production record of Well No. 46, taken from monthly production reports furnished by the company.

Year and month		Barrels of clean oil	Parts of water	Per cent of water	Number of days produced
1917	June	381			3
	July	6,490			31
	August	5,770			31
Total		12,641			

The production of clean oil from the second zone at this well means considerable to the company in the matter of extending the proved area on the property.

#### Well No. 47.

Drilling was commenced January 24, 1917.

This well is located between old wells drilled by the Murphy Oil Company, from which little information could be gathered at the time approval was given the company to shut off water at their proposed depth of 1800'. Attention was directed to the serious water condition of adjoining wells and that results obtained in drilling this well would probably afford some evidence toward the cause of this condition.

Records and peg models compiled by this department, subsequent to our Report on Proposed Operations, approved shut-off point and indicate that the first zone was encountered at a depth of 792'.

Ten inch casing was cemented at 1389' and test of water shut-off approved. The second zone was encountered at 1391' and according to the log continued to 1525'. There are no records at hand to show that the second zone was *tested*. Drilling was continued and 8½" casing cemented at 2377'. Study of the log and peg model indicates that top of the third zone probably begins with "brown shale, light showing of oil and gas" encountered at 2134', or 143' above the lowest shut-off point.

Following is a portion of our Report on Test of Water Shut-off, No. T 1-10, dated August 3, 1917:

"Proposal to shut off water below a depth of 1800' was not received, and approval of the shut off with 10" casing cemented at a depth of 2383' is withheld, pending investigation and receipt of report, which is hereby requested from the company, showing that this is the proper depth to shut off water and that oil formations shut off have been protected from water."

On August 10 the company replied to this report, stating that no reason was found for shutting off at 1800' and that there were no indications of oil until a depth of 2134', where "brown shale, light showing of oil and gas" was encountered and continued to 2154', and that similar conditions prevailed at 2271'–2288'. The following statement was made in this letter: "In cementing 8½" casing at 2377', sufficient cement—200 sacks—was used to go up behind the casing and protect from water formation logged 'light showing of oil'".

No mention, however, was made about the protection of the second zone in which "oil sands" were logged and shut off. No definite evidence has been presented to show that the second zone has been protected from water.

The well was drilled to a depth of 2645' and produces from the lower portion of the third zone. The well was put on the pump September 8, 1917, and produced as follows:

	September production
Barrels of clean oil.....	1,639
Barrels of water.....	
Per cent water.....	
Number of days produced.....	23

Study of the production record shows that the third zone carries clean oil at this well.

#### Well No. 48.

Drilling was commenced March 13, 1917.

The following is a part of our Report on Proposed Operations, written April 23, 1916:

"Herewith please find data on Standard Oil Company's wells in the area adjoining this well. These data show that the water condition of some of these wells is serious.

Records at hand indicate that two oil zones should be penetrated in this well. The upper sand carried heavy oil and possibly some water in the down-slope portion of the sand. The upper zone should be protected from water until such time as it is definitely proven that this sand carried water.

Therefore I recommend that the company protect the upper zone from top water, and if water develops in the well from the upper zone sand that the lower zone sand be protected from this water.

The accompanying data show that water has not been shut off at a uniform stratigraphic depth in this area, indicating that this fact is the cause of some of the water trouble in this section."

The company carried out the first part of our recommendation and shut off water above the first zone with 12½" cemented at 1521'. Test of water shut-off was approved.

Ten inch casing was cemented at a depth of 2162' and test of water shut off approved as satisfactory. The well was drilled to a depth of 2312' and put on the pump September 23, 1917. A letter from the company states that the well averaged 221 barrels of oil and no water during the last 7 days in September.

Study of the log record and peg model indicates that the upper portion of the second zone was shut off with 10" casing. There are no records at hand to show that tests were made to determine the presence or absence of "intermediate" water between the first and second zones. The production record shows that the second zone is free from water at this well.

#### Well No. 49.

Drilling was commenced May 3, 1917. The company originally proposed to shut off water at a depth of 2160', and amended the notice by proposing to make an additional shut-off at 1400'. This department recommended first shut-off at about 1500' and approved the second shut-off point at 2160' as proposed.

The log shows that the top of the first zone was encountered at 1686'. Water was shut off with 12½" casing cemented at 1687'. Test witnessed and approved on August 15, 1917. On August 21 the following letter was written to the company:

"Our report on test of water shut-off, No. T 1-14, dated August 15, 1917, approved test of water shut-off with 12½" casing cemented at a depth of 1687', in Murphy-Whittier well No. 49, Section 26, T. 2 S., R. 11 W. Our decision No. CC-305, dated June 12, 1917, approved proposal to make additional shut-off at a depth of about 2160' in order to protect the second oil zone.

There appears to be no definite evidence as to the presence or absence of a water-bearing formation, in the area adjoining this well, between the first and second oil zones. Since recent wells drilled in this area make shut-offs above both of these zones, we think it would be advisable to thoroughly test the formation between 1687' (shut-off point) and 2160' (proposed shut-off point) in order to determine the kind and volume of fluid contained in these formations. This information should be of much value in planning future shut-offs above the first and second oil zones.

We would appreciate having your views in this matter."

No reply to this letter has been received and suggestions contained therein have not been carried out. The manner in which the company ignored this letter suggests that more positive action than merely writing letters, seems necessary in matters of this kind.

The well reached a depth of 2235' October 30, and drilling was being continued.

**Well No. 50.**

Notice of intention to commence drilling was received April 2, 1917. The company estimated that productive oil sand should be encountered at a depth of 2500'. The proposal to shut off water at 1950' was approved.

Drilling was commenced May 25, 1917. A supplementary report on depth of water shut-off was made by this department on August 11, 1917, as follows:

"A study of our peg model, showing development work subsequent to the issuance of our decision mentioned, indicates that water should be shut off in the neighborhood of a depth of about 1750', providing an oil sand is not encountered above this depth."

There is some question as to the depth at which the first zone was encountered. The top of this zone may begin at 1465', where "sandy shale showing a little heavy oil" was encountered, or it may begin at a depth of 1687' with "Brown sandy shale showing a little heavy oil"; 10" casing was cemented at 1641', but failed to shut off water. The company succeeded in getting circulation around this casing and pumped in three tons of cement under 800 lbs. pressure. The well stands re-cemented at this time.

The drilling so far shows that careful work has been done and that the company is endeavoring to protect the first zone from water encountered in this well.

**Well No. 51.**

Drilling was commenced July 16, 1917. The proposed estimates of depth of water shut-off and depth at which the first zone should be encountered has been approved by this department.

**Well No. 52.**

Drilling was commenced August 23, 1917. The proposed estimates of depth of water shut-off and depth at which the first zone should be encountered has been approved by this department.

**GENERAL SUMMARY.**

The following wells were completed prior to December 1, 1913, when the property was taken over by the Standard Oil Company: Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27 and 28. Wells Nos. 4, 9, 10 and 27 had been abandoned by the Murphy Oil Company. The index map on the diagram of wells shows the location of Old Nos. 13, 16, 17 and 19, which were also abandoned by the Murphy Oil Company.

In general, the logs and histories of the old wells drilled by the Murphy Oil Company are very incomplete, due, perhaps, to the lack

of foresight of the former owners to keep necessary records. On account of the lack of proper records and the serious water condition of many of the old wells, the Standard Oil Company was confronted with problems which appear to have been reflected into later wells drilled. Study of records filed here fail to show that *any* remedial work was done by the Standard Oil Company to eliminate water troubles in the old wells, except to abandon No. 26 and No. 28. Some of the present water trouble may be due to deterioration of casing, allowing water to enter them through the water string. Probably the greater part of the trouble is due to ineffectual methods of shutting off water and lack of knowledge of geological conditions in shutting off at proper depths.

The production report for the month of August, 1917, shows 38 producing wells. Twenty of these wells were completed by the Murphy Oil Company, and produced 14,926 barrels of clean oil and 33,630 barrels of water; out of a total of 73,709 barrels of oil and 70,755 barrels of water produced by all the wells on the property. According to these figures, the wells drilled by the Murphy Oil Company averaged 1681 barrels of water, each, and wells drilled by the Standard averaged 2063 barrels of water, each, during August. Wells drilled by the Standard Oil Company produced 37.125 barrels of water, which amounted to 52.4 per cent of all the water produced on the property during August.

It would seem unlikely that the cement jobs in the new wells would have failed to the extent of allowing so much water to enter these wells, or that the old wells should be the cause of the major portion of this trouble. Therefore it would seem reasonable to assume that the source of the water is either through the various zones, or "intermediate" water between them.

The following record of wells tends to show that the various oil zones penetrated do not carry "edge" water and that the *source* of most of the water produced by the various wells is "intermediate" water from between the oil zones.

The following wells produce from the first zone *only*:

Wells Nos. 40, 43 and 45. The combined production of these wells during August was 1523 barrels of oil and 687 barrels of water. These wells averaged less than eight barrels of water per producing day. They may be affected by water from adjoining wells, or make their own water resulting from ineffectual shut-offs. Well No. 45 averaged less than two barrels of water daily, and since this well is deeper stratigraphically than either No. 40 or No. 43, it suggests that the cause of the water condition of the latter wells does not result from "edge" water.

The following wells produce from the second zone *only*:

Wells Nos. 23, 38, 39, 42, 44, 46 and 48. No. 48 was completed September 23, daily average 221 barrels of oil and no water. Reference to "Map showing average amounts of water produced daily by various wells in August," Fig. 10, shows that *all* of these wells are shown in "yellow." Reference to similar map showing "oil" produced, Fig. 11, shows that they are among the best producers on the property.

These wells produced a total of 27,845 barrels of oil and 5 barrels of water during August. The figures show *absolutely* that the second zone does not carry "edge" water in present area drilled. These wells are fairly well distributed over the present proved area of the property. Special attention is directed to the fact that wells Nos. 44, 46, 42, 39 and 48 are among the farthestmost producing wells, down the dip of the formation, and should be first of present producing wells on the property to show "edge" water from the second zone.

The following wells were drilled into the second zone and there is some question (on account of shut-off and perforation record) as to whether they produce from the first zone, in addition to the second zone:

Wells Nos. 21, 22, 24 and 37.

Of these Nos. 21 and No. 22 produce only a small amount of water and oil. Wells No. 24 and No. 37 produce relatively large quantities of water and oil. By referring to "Summary of evidence at each well," it will be noted that there was some question as to the effectiveness of water shut off above the first zone in well No. 24. The depths of these two wells below the second zone suggests the possibility of entrance of water from below this zone. It is possible that water may enter them from between the first and second zones. Adjoining well No. 44 may have been troubled with water from the same source, before shutting off immediately above the second zone, which work cleaned up the well.

The production of wells producing from the first or second zone individually indicates that the source of water is not through these zones. Therefore the source of water must be above them or below them. The water condition of these two wells shows the necessity of determining whether or not there is an "intermediate" water between the first and second zone. Attention is again called to the letter from this department dated August 21, 1917, to the Standard Oil Company, suggesting tests at well No. 49. These tests were not made.

Study of the peg model and cross section indicates that the following wells penetrate the third zone:

Nos. 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 25, 26, 27, 29, 30, 31, 32, 33, 34, 35, 36, 41.

(Forty-seven was drilling during August.)

Of these wells, the ones shown in symbols and colors on the maps, "Average amounts of *water* and *oil* produced daily by various wells in August, 1917," see Figs. 10 and 11, produced during August.

The outstanding feature of the "water" map is that every well shown in *Red*, except No. 37, produces from the *third* zone.

Recent developments at well No. 47, in which water was shut off above the major portion of the third zone shows that this zone is free from water at this well, and shows further that "intermediate" water was encountered between the second and third zones.

Study of the records indicate that the first zone has been shut off in all of these wells, except, possibly, No. 25, in which the record is not entirely clear. Therefore, it appears that the source of most of the water produced by "third" zone wells is between the second and third zones, or possibly through the third zone in its down slope portion.

The log records show only two wells (13 and 19, drilled by Murphy Oil Company) in which water-bearing formations are reported below or between any of the three oil zones. In view of this and the number and distribution of wells producing large amounts of water, it seems that the former policy of drilling wells on this property should be changed so that water-bearing formations may be definitely located and recorded in future wells drilled, which penetrate these formations, in order that necessary remedial work on present well may be instituted and carried out in the proper manner.

On account of the large amount of water produced by wells on this property, it will be necessary to put in plugs and conduct certain tests to secure information relative to exact location of water, which should have been obtained at the time the wells were drilled.

It is remarkable that practically every well which produces from *one zone only*, produces *clean oil*, indicating that the earlier wells drilled are not responsible for the bulk of the water trouble on this property, as has been generally supposed by people not entirely familiar with the conditions as they actually exist.

### RECOMMENDATIONS.

Recent developments show that the property offers many possibilities in the amount of recoverable oil and warrants the expenditure of considerable money in adequately protecting the various zones from water.

(1) Water should be shut off *above* the first zone in each new well drilled, particularly along the southern and western edges of the present producing areas. Three wells are now producing commercial quantities of oil from the *first zone only*, in this area. New wells drilled farther south and west may find increasing quantities of oil in this zone, at greater relative depths. The policy of protection should be pursued until it has been demonstrated that the first zone "pinches out"; carries "edge water," or is barren of oil.

(2) Possible water-bearing formations should be located between first and second zones. This should be done in deepening by stages and testing.

(3) Depth and thickness of possible water-bearing formations should be determined, so far as possible, in all new wells drilled *below* the second zone. (The main source of the present water trouble seems to be between second and third zones.)

(4) In the future, wells should not be drilled into the third zone until the "intermediate" water between these zones can be prevented from entering either the second or third zone.

(5) Suggestions made in "Summary of evidence at each well" regarding plugging lower portions of wells 24, 37 and 40 should be carried out as a matter of initial tests to determine, if possible, source of water entering these wells.

(6) The production of oil from the following wells probably does not pay for their maintenance and operation: Nos. 2, 3, 5, 6, 12, 13, 15, 19 and 22. No. 12 and No. 13 produce large quantities of water. The water condition of the property probably would be improved by properly plugging and abandoning all of these wells.

(7) The water situation could be greatly improved by shutting off water in wells Nos. 25, 32, 34, 35 and 36. Possibly this could be largely accomplished by effectively plugging these wells between the second and third zone.

(8) The condition of well No. 41 shows the necessity of immediate repair work.

(9) The depth at which fluid stands and amount of tubing in each producing well should be determined and used in a manner similar to the "Creme case" at Coalinga.

(10) Chemical analysis of water from wells which produce water may serve a purpose equally as useful, in determining source of water as at Coalinga.

(11) The value of perforation record has been pointed out in a number of cases in the report and extreme care should be exercised by the company in keeping record of perforation of oil strings.

(12) A definite system should be worked out between this department and the Standard Oil Company for protection of the various zones penetrated, with the use of the least amount of casing necessary. (Possibly this may mean the introduction of the mud-laden fluid method of drilling new wells, which penetrate more than one zone. This may best be accomplished by a meeting of representatives of the Geological and Producing Departments of the Standard Oil Company with representatives of this department in our Los Angeles office at an early date.

M. J. KIRWAN,  
Deputy Supervisor.

## DECISIONS.

## COYOTE HILLS FIELD.

T. 3 S., R. 9 W., S.B.B. &amp; M.

## SECTION 18.

## Union Oil Co.

G. &amp; L. Well No. 15, alter casing. P 1-281.

Approved proposal to swedge out oil string.

G. &amp; L. Well No. 40, supplementary to drill-plug bottom. P 1-54.

The company advised that five unsuccessful attempts were made to get cement to set near the bottom of the well. Approved a proposal to force mud into a sand penetrated near the bottom of the well, previous to placing cement above this sand. Production reports show that water was shut off.

G. &amp; L. Well No. 41, shut off. T 1-12.

Shut-off approved.

G. &amp; L. Well No. 42, shut off. T 1-19.

Approval of the test was not given pending receipt of information relative to character of the S' plug of formation found in the lower portion of the water string. At the time of the test it was not known whether or not this plug could prevent the entrance of water into the casing.

G. &amp; L. Well No. 42, shut off. T 1-24.

It was found necessary to use the tools to clean out the S' plug mentioned in T 1-19. A subsequent test showed water to be satisfactorily shut off.

G. &amp; L. Well No. 42, deepen. P 1-297.

After the well had been completed and produced about two months, the company proposed to deepen. A request was made by the department for the log of the well.

G. &amp; L. Well No. 42, supplementary to deepen. P 1-311.

Approval to deepen was given with the understanding that, if the amount of water which the well was producing increased to damaging amounts, necessary repair work would be done.

G. &amp; L. Well No. 42, plug bottom. P 1-357.

The well was deepened as proposed under P 1-311. Approved proposal to plug well between certain depths to shut off water reported encountered in sand near the bottom.

G. &amp; L. Well No. 43, commence drilling. P 1-57.

Proposed water shut-off depth approved.

G. &amp; L. Well No. 43, shut off. T 1-71.

Shut-off approved.

## Standard Oil Co.

Well No. 1, abandon. P 1-3.

Proposed plan to abandon was approved. It was suggested that the company cut instead of shoot 8½" casing near the surface and drive a wood plug into the 8½" where cut and dump about 10 sacks of cement on top of the plug.

Well No. 1, supplementary to abandon. P 1-10.

Approved proposal from company to shoot, and plug with cement, between certain depths. This was in addition to work approved in Decision P 1-3.

## SECTION 19.

## San Diego Consolidated Oil Co.

Well No. 1, abandon. P 1-137.

Recommendations were made indicating depths at which well should be plugged with cement, and that department be notified so that inspections could be made to determine if cement was put in between proper depths and also determine if cement set properly.

## San Diego Consolidated Oil Co. -Continued.

Well No. 1, test cement plug. T 1-74.

An inspection was made to locate the top of a cement plug and determine if cement set properly.

Well No. 1, test cement plug. T 1-88.

Approved the placing and setting of cement in the second cement plug.

Well No. 1, test cement plug. T 1-115.

Approved the placing and setting of cement in the third and last cement plug recommended by the department.

Well No. 3, deepen. P 1-51.

The proposal to deepen was approved.

Well No. 4, make production test. P 1-50.

This well was redrilled to shut off water. After bailing tests were made, the company received the approval of the department to pump the well for further test for water shut-off.

## Calokla Oil Co.

Basten Well No. 1, alter casing. P 1-31.

Proposal to remove upper portion of oil string was approved.

Basten Well No. 2, alter casing. P 1-43.

It was recommended that the company make an effort to shut off water by shooting and plugging a certain portion of the lower part of the well before removing the 8 $\frac{1}{4}$ " casing.

Basten Well No. 2, redrill. P 1-88.

A supplementary notice received from the company gave additional information relative to former shooting and plugging and proposing to do additional shooting and plugging higher up. This proposal was approved.

Basten Well No. 3, alter casing. P 1-32.

Approved proposal to pull out upper portion of 8 $\frac{1}{4}$ " casing, leaving a lap of about 50 feet up into the water string.

## Providential Oil Co.

Well No. 1, deepen. P 1-34.

Proposal to deepen was approved.

Well No. 5, abandon. P 1-340.

Study of the log of the well and our peg model indicated that well was not drilled deep enough to encounter oil bearing formations protected by wells in this territory. Approval to abandon was given. No plugging was required.

## Fetterman Oil Co.

Well No. 1, abandon. P 1-97.

The company requested the department to issue recommendation covering work necessary in abandonment. Recommendations were made covering the details of work indicating the depths at which plugging should be done.

Well No. 1, test cement plug. T 1-87.

The inspection made both before and after the cement plug put in between depths of 3300' and 3270' showed that the recommended work had been done and cement set to the satisfaction of the department.

Well No. 1, test cement plugs. T 1-101.

This decision covers the inspection of the well both before and after the placing of two cement plugs. The results of the work were found to be satisfactory.

Well No. 2, abandon. P 1-99.

This report supplemented and amended former report No. CC-300. Recommendations were made in which depths of shooting and plugging were given.

Well No. 2, test of cement plugs. T 1-61.

The inspection of the first plug showed that additional cement was necessary to fill up the space required. The inspection of the second plug placed between depths of 2800' and 2870' proved satisfactory.

Well No. 2, test cement plug. T 1-67.

The results of inspection showed that a cement plug had been satisfactorily placed between depths of 2650' and 2625', as recommended. This completed the plugging of the well.

## Fetterman Oil Co.—Continued.

Well No. 3, abandon. P 1-98.

Upon request of the company, specifications were issued covering work necessary in the abandonment of this well.

Well No. 3, test cement plug. T 1-130.

An inspection made both before and after the placing of a cement plug between depths of 3300' and 3270' proved satisfactory.

Well No. 3, test cement plug. T 1-137.

Inspections made before and after placing a cement plug between depths of 2980' and 2940' showed that this plug had been satisfactorily put in.

Well No. 3, test cement plug. T 1-143.

An inspection similar to the one under T 1-137 for cement plug between depths of 2760' and 2720' showed that work was done according to recommendations.

Well No. 3, test cement plug. T 1-153.

Approval was given the work of placing a cement plug between depths of 2550' and 2500'. This completed the plugging of the well.

## Fullerton Great West Oil Co.

Well No. 3, make pumping test. P 1-49.

Following shooting and plugging between depths of 2780' and 2770', the company proposed to make a pumping test to determine the effectiveness of the plugging. This proposal was approved.

Well No. 3, continue pumping. P 1-73.

The company advised that the water condition of the well had improved as a result of pumping. Approval was given proposal to continue pumping for thirty days. Following this, extensions were given for two additional 30-day periods.

Well No. 3, redrill. P 1-166.

Approved redrilling proposal to repair well in order to prevent water from above the oil bearing formation to enter the well.

Well No. 3, abandon. P 1-231.

Recommendations were made covering necessary work of shooting and plugging.

Well No. 3, test cement plug. T 1-171.

A test was witnessed to locate top of a cement plug reported between depths of 3780' and 3770'. An error in measurement of 47' was found by the inspector. Recommendations were made to use the tools and clean out until definite showings of cement were encountered.

Well No. 3, test cement plug. T 1-194.

The well was found open to a depth of 3780'. Cement was afterward put in filling up to 3760'. This completed the work for the first plug.

Well No. 3, test cement plug. T 1-193.

Inspections showed that a cement plug was put in between depths of 3704' and 3684', as recommended by the department.

Well No. 3, test cement plug. T 1-201.

A cement plug was satisfactorily placed between depths of 3518' and 3490'.

Well No. 3, test cement plug. T 1-203.

The measurement of the depth to which the hole was open following shooting was witnessed and found satisfactory.

Well No. 3, test cement plug. T 1-214.

The results of an inspection showed that a cement plug had been put in between depths approved by the department. This completed the plugging of the well.

## SECTION 29.

## Union Oil Co.

Chapman Well No. 1, shut off. T 1-223.

The results of the test showed that water was entering the well at the rate of 125' per hour. Approved proposal from the company to force cement back of the water string.

## T. 3 S., R. 10 W., S.B.B. &amp; M.

## SECTION 8.

## Tri-State Oil Co.

Well No. 1, shut off. T 1-55.

Test of water shut-off satisfactory. 3" casing was cemented at a depth of 5135'.

Well No. 1, shut off. T 1-172.

2" casing was cemented at a depth of 5472' but failed to shut off water. However, approval was given to continue drilling prospecting for an oil bearing formation.

Well No. 1, abandon. P 1-367.

Approved proposal to abandon. Recommended that company place a 20' plug of cement on the top of each string of casing after removing of as much of the upper portions as could be obtained. Approval was also given the company to make tests of formations formerly shut off.

## SECTION 13.

## Amalgamated Oil Co.

Anaheim Well No. 1, abandon, P 1-142.

Recommendations were made giving depths at which shooting and plugging should be done.

Anaheim Well No. 12, continue plugging. P 1-13.

Approved proposal to continue plugging the lower portion of the well.

Anaheim Well No. 12, shut off. T 1-127.

The results of the test and information furnished by the company relative to a pumping test indicated that the plug placed near the bottom of the well shut off the water.

Anaheim Well No. 28, plug lower part of well. P 1-25.

Approved proposal to plug lower portion of well as proposed by the company. recommended that in case this work did not shut off water, all old plugs be drilled out and a shot of about 150 pounds gelatine be exploded near the bottom and well replugged with cement.

## SECTION 17.

## Standard Oil Co.

M/C Well No. 31, shut off. T 1-39.

The results of the test showed that water was not shut off. Approved verbal proposal from a representative of the company to conduct further bailing tests and test casing for casing leak.

M/C Well No. 31, supplementary to drill. P 1-114.

Approved proposal to cement 6 $\frac{1}{4}$ " casing in next suitable formation at a depth not to exceed 100' below former shut off point.

M/C Well No. 31, shut off. T 1-68.

The results of the test showed that water was not shut off with the 6 $\frac{1}{4}$ " casing. The test was not approved.

M/C Well No. 31, supplementary to drill. P 1-160.

Approval to rip off the 6 $\frac{1}{4}$ " casing at bottom of 8 $\frac{1}{4}$ ", deepen and shut off water in next suitable formation was given. The old 6 $\frac{1}{4}$ " was to be filled with cement up to the point where cut off. Recommendation was made that company mud formations, between the shoe of the 8 $\frac{1}{4}$ " casing and new shut-off point, under a pressure of at least 400 lbs. per sq. in., previous to cementing the new string of 6 $\frac{1}{4}$ " casing.

M/C Well No. 31, supplementary to drill. P 1-198.

Approved proposal to shoot off lower portion of 8 $\frac{1}{4}$ " casing. On account of changed physical condition of well, minor changes were made in recommendations relative to depth of mudding made in report P 1-198.

M/C Well No. 31, supplementary to drill. P 1-356.

While sidetracking lower portion of old hole, the company found that a small amount of oil began flowing between the 8 $\frac{1}{4}$ " and 10" casings. The company

promptly filed a proposal to shoot the old holes together and thoroughly plug them; cement casing above sands formerly shut off in order to test them.

M/C Well No. 31, supplementary to drill. P 1-368.

Approved proposal making change in depth of placing one of the cement plugs mentioned in Report P 1-356.

M/C Well No. 36, commence drilling. P 1-109.

Proposed shut-off depth approved.

M/C Well No. 36, shut off. T 1-149.

The results of the test indicated that water was not shut off. Approved proposal to force cement back of the water string.

M/C Well No. 36, shut off. T 1-161.

Test of water shut-off was witnessed to determine the rate at which water was entering the well through a casing leak.

M/C Well No. 36, test. P 1-276.

Approved proposal to carry 6 $\frac{1}{4}$ " casing from 100' to 200' below shoe of 8 $\frac{1}{4}$ " bridge inside of this 6 $\frac{1}{4}$ ", perforate and force cement through perforations in order to cement 6 $\frac{1}{4}$ " and 8 $\frac{1}{4}$ " casings together, to shut off water entering through casing leak.

M/C Well No. 36, shut off. T 1-176.

The test showed that water was not shut off. Approved proposal to force additional cement through the perforations in the 6 $\frac{1}{4}$ " casing.

M/C Well No. 36, shut off. T 1-180.

The test showed that water was not shut off. A proposal from the company to force additional cement out through perforations in the 6 $\frac{1}{4}$ " casing was approved.

M/C Well No. 36, shut off. T 1-187.

The company advised that the 6 $\frac{1}{4}$ " casing was ripped  $\frac{3}{8}$ "x8" and 40 sacks of cement forced out between the 6 $\frac{1}{4}$ " and 8 $\frac{1}{4}$ " casings. A subsequent test showed that water was not shut off.

M/C Well No. 36, shut off. T 1-198.

Following the test T 1-187, the company again ripped the 6 $\frac{1}{4}$ " casing and forced out 50 sacks of cement. Subsequent tests witnessed showed that the company effected a complete water shut-off.

#### SECTION 18.

Standard Oil Co.

M/C Well No. 2, redrill. P 1-113.

The proposal to redrill on account of collapsed oil string, and deepen, was approved.

M/C Well No. 2, abandon. P 1-174.

Approved proposed method of shooting and plugging.

M/C Well No. 15, shut off. T 1-66.

Production test was witnessed to determine amount of water the well was making previous to recementing the 4 $\frac{1}{2}$ " casing.

M/C Well No. 15, redrill. P 1-143.

Approved proposal to force cement back of 4 $\frac{1}{2}$ " casing which had been cut off 40' below the shoe of the water string. A bridge had been placed in the 4 $\frac{1}{2}$ " below point where cut off.

M/C Well No. 15, shut off. T 1-83.

A production test showed that water was not entirely shut off. Recommended pumping for further test.

M/C Well No. 15, abandon. P 1-268.

The general plan of proposed shooting and plugging was approved. Recommendations were made concerning certain details of the work.

M/C Well No. 15, supplementary to abandon. P 1-295.

Approved proposal changing depth at which first cement plug should be placed.

M/C Well No. 15, test cement plug. T 1-183.

The first cement plug was found to have been placed as recommended.

Standard Oil Co.—Continued.

M/C Well No. 29, supplementary to drill. P 1-8.

A pumping test showed that a sand below the shoe of the 8 $\frac{1}{4}$ " casing was probably not productive. Approved proposal to cement 6 $\frac{1}{4}$ " casing below this sand.

M/C Well No. 29, shut off. T 1-17.

Shut-off approved.

M/C Well No. 30, supplementary to drill. P 1-11.

Approved proposal to continue drilling and cement casing above first showing of oil.

M/C Well No. 30, shut off. T 1-22.

Shut-off approved.

M/C Well No. 34, drill. P 1-19.

Approved depth at which company proposed to shut off water.

M/C Well No. 34, supplementary to drill. P 1-124.

A supplementary proposal to continue drilling to the first oil sand and shut off above same was approved.

M/C Well No. 34, shut off. T 1-65.

Shut-off satisfactory.

M/C Well No. 35, drill. P 1-18.

The proposal from the company to shut off water at a depth of about 3300' was approved.

M/C Well No. 35, shut off. T 1-49.

The results of the test showed that about 229' of water and about 250' of oil entered the well in 25 hours. The company agreed to file a proposal covering further work.

M/C Well No. 35, supplementary to drill-recement. P 1-135.

A proposal to pump well in order to try and open channel back of the 8 $\frac{1}{4}$ " casing and then force cement back of this casing was approved.

M/C Well No. 35, shut off. T 1-73.

The work approved in Report P 1-135 was carried out, but was not successful in shutting off the water.

M/C Well No. 35, recement. P 1-176.

Approved proposal to force additional cement back of the 8 $\frac{1}{4}$ " casing.

M/C Well No. 35, shut off. T 1-111.

The results of the test showed that water was not shut off.

M/C Well No. 35, supplementary to drill-recement. P 1-217.

Approved proposal to plug up 10' inside of 8 $\frac{1}{4}$ " casing and make casing test; perforate bottom joint of 8 $\frac{1}{4}$ " and force cement out through perforations.

M/C Well No. 35, shut off. T 1-135.

Previous to carrying out work mentioned in Report P 1-217, the company pumped 40 sacks of cement into well under 1200 lbs. pressure. A test showed that a small amount of water and no oil entered the well. Recommended drilling 10' more and test again.

M/C Well No. 35, shut off. T 1-142.

The test showed an increase of fluid, consisting of about one half water and one half oil. Approved proposal to plug bottom 10' of water string and perforate above plug to determine if water was entering well from back of water string.

M/C Well No. 35, shut off. T 1-158.

Work approved in Report T 1-142 was carried out. Subsequent tests showed a small amount of oil and water entered, possibly through the plug which was cleaned out to 6' in length. Approved proposal to replug with cement.

M/C Well No. 35, shut off. T 1-160.

The lower part of the 8 $\frac{1}{4}$ " was replugged as indicated in Report T 1-158. A test showed that 75' of water and 15' of oil entered the casing in 12 hrs., indicating that there probably was a passage of fluid back of the water string.

## Standard Oil Co.—Continued.

M/C Well No. 35, supplementary to drill. P 1-269.

Approved proposal to shoot and plug lower portion of the well and cement new water string above the oil sand.

M/C Well No. 35, shut off. T 1-234.

The test showed that water was not shut off. No oil was noted during the test, indicating that the source of the water was above the oil sand. Approved proposal to recement.

M/C Well No. 35, shut off. T 1-250.

Water was not shut off. Approved proposal to swab well in order to open up channel back of 8 $\frac{1}{4}$ " casing and force cement back of this casing.

M/C Well No. 37, commence drilling. P 1-66.

Shut-off depth approved.

M/C Well No. 37, shut off. T 1-90.

On account of the mixture of oil and water, the results of the test did not afford sufficient information to approve the shut-off. Recommended further bailing tests.

M/C Well No. 37, shut off. T 1-95.

The results of this, and former tests, indicated, but did not clearly demonstrate that water was shut off. Approval was given to continue drilling with the understanding that production test would be witnessed 30 days after completion.

M/C Well No. 37, shut off. T 1-190.

The results of production test showed that the well was making only 0.4 per cent water. Water shut-off approved.

M/C Well No. 38, commence drilling. P 1-108.

The department's estimate of depth of water shut-off and depth to oil bearing formations was given.

M/C Well No. 38, supplementary to drill. P 1-233.

Approved proposal to continue drilling and cement at a depth lower than indicated for shut-off in P 1-108.

M/C Well No. 38, shut off. T 1-182.

Several tests were witnessed and, due to the amount of oil in the well and fact that free water was not definitely located, the company decided to make further bailing tests.

M/C Well No. 38, shut off. T 1-188.

On account of the rise of a small amount of water while standing bailed for test, the company's proposal to make production test 30 days after completion was approved.

M/C Well No. 42, commence drilling. P 1-180.

The proposed shut off depth was approved.

M/C Well No. 42, shut off. T 1-207.

Several tests witnessed were not conclusive, on account of the mixture of water and oil and change in level of the free water. It was suggested that the company bail all free water from the well and make a further test.

M/C Well No. 42, shut off. T 1-208.

All free water had been bailed out. During the test the oil in the well stood near the surface. Samples of fluid from various depths showed a small amount of water and emulsion by centrifuge test. Approval to continue drilling was given. Recommended production test after completion.

M/C Well No. 44, commence drilling. P 1-288.

Recommended that the company test out an upper oil bearing formation which had been shut off in all other wells drilled in this field.

M/C Well No. 44, shut off. T 1-248.

Recommendations in Report P 1-288 were carried out. On account of the amount of oil in the hole, a bailing test did not conclusively show that water was shut off. Approved proposal from the company to make a further bailing or pumping test.

Standard Oil Co.—Continued.

M/C Well No. 45, commence drilling. P 1-299.

Recommendation was made that company shut off above a specified depth, so that shut-off could be tested before entering oil bearing formation, and in this way simplify the test.

#### SECTION 19.

Standard Oil Co.

M/C Well No. 10, deepen. P 1-320.

Water condition of well satisfactory, approved proposal to redrill and deepen.

M/C Well No. 26, redrill. P 1-45.

Approved proposal to bridge in oil string below water string, remove oil string above bridge, replace perforated casing with solid pipe having perforated die-nipple on bottom, screw on to casing remaining in well and force cement through the perforations below water string in an effort to shut off "top" water.

M/C Well No. 26, supplementary to redrill. P 1-145.

A supplementary notice from the company states that the oil string had been plugged with cement from bottom of hole to a point near the water string and tests showed that water was entering well from above the oil sand. Approved proposal to rip off 64" casing about 20' below water string and cement same above first oil sand.

M/C Well No. 26, shut off. T 1-81.

Test of water shut-off approved.

M/C Well No. 26, deepen. P 1-218.

Proposal to deepen approved.

M/C Well No. 32, shut off. T 1-5.

Shut-off approved.

M/C Well No. 33, shut off. T 1-48.

The results of several tests indicated but did not clearly demonstrate that all water was shut off. Recommended that company continue bailing tests or complete well and make production test after completion.

M/C Well No. 33, shut off. T 1-189.

Production test showed that well averaged less than 0.4 per cent water. Test of water shut-off approved.

M/C Well No. 40, commence drilling. P 1-186.

Proposed shut-off depth approved.

M/C Well No. 41, commence drilling. P 1-210.

Proposed shut-off depth approved.

M/C Well No. 41, shut off. T 1-245.

A test was witnessed previous to drilling out cement plug in bottom of water string, to determine the rate at which water was entering through a casing leak.

M/C Well No. 41, supplementary to drill. P 1-373.

Approved proposal to drill out cement in bottom of water string and if test showed that no water other than through casing leak was entering well to perforate water string just below the leak and force cement through the perforation and cement together the water string and next outside casing.

M/C Well No. 41, shut off. T 1-247.

There was no apparent change in the water level after drilling out plug below water string. The company proposed to plug the lower part of the water string and make another casing test.

M/C Well No. 43, commence drilling. P 1-214.

Proposed shut-off depth approved.

M/C Well No. 43, supplementary to drill. P 1-362.

Approved supplementary proposal to continue drilling below depth approved in P 1-214, prospecting for oil bearing formations.

M/C Well No. 46, drill. P 1-333.

Proposed shut-off depth approved.

## Standard Oil Co.--Continued.

M/C Well No. 48, drill. P 1-360.

Recommended that company shut off above first oil bearing formation penetrated below a specified depth.

M/C Well No. 49, drill. P 1-361.

Recommendation similar to P 1-360 was made.

## SECTION 20.

## Standard Oil Co.

M/C Well No. 39, commence drilling. P 1-127.

Shut-off depth approved.

M/C Well No. 39, shut off. T 1-169.

The results of the bailing test indicated but did not afford sufficient information to give final approval. Recommended production test after completion of the well.

M/C Well No. 39, shut off. T 1-233.

Test of water shut-off approved after production test was witnessed.

M/C Well No. 47, drill. P 1-355.

The estimated depth at which oil bearing formation should be penetrated, furnished by the company, agreed with information derived from study of peg model constructed by this department.

## SECTION 21.

## Union Oil Company.

Bastanchury Well No. 5, shut off. T 1-13.

Test of water shut-off approved.

Bastanchury Well No. 5, redrill and plug. P 1-250.

Approved proposal to redrill and plug off "bottom" water. Recommended that company force thin mud into lower sand.

Bastanchury Well No. 5, supplementary to redrill. P 1-255.

Approved proposal from company to shoot lower portion of well over a greater distance than recommended in report P 1-250.

Bastanchury Well No. 5, supplementary to redrill. P 1-293.

Approved proposal to remove all 4½" casing possible and redrill with rotary to a point where shooting and plugging was formerly proposed and approved.

## SECTION 22.

## Union Oil Company.

Hole Well No. 17, shut off. T 1-32.

Shut-off approved.

## Standard Oil Company.

Coyote Lease No. 2 Well No. 8, alter casing. P 1-146.

Approved proposal to remove upper portion of the oil string.

Coyote Lease No. 2 Well No. 9, supplementary to drill. P 1-48.

Approved proposal to drill below the 10" casing prospecting for lower oil bearing formations above which the company planned to try another shut-off.

Coyote Lease No. 2 Well No. 9, shut off. T 1-46.

Shut-off approved.

Coyote Lease No. 2 Well No. 9, plug and alter casing. P 1-206.

Approved proposal to shoot and plug lower portion of well.

## SECTION 23.

## Union Oil Company.

Hole Well No. 8, shut off. T 1-144.

Shut-off approved.

Hole Well No. 10, deepen. P 1-222.

Proposal to deepen was approved.

Well No. 12, shut off. T 1-145.

Shut-off approved.

## Union Oil Co.—Continued.

Hole Well No. 15, shut off. T 1-27.

Shut-off approved.

Hole Well No. 16, shut off. T 1-29.

The result of the test indicated but did not give sufficient information to prove that all water was shut off. Approval to continue drilling was given with understanding that production test would be witnessed after completion.

Hole Well No. 16, shut off. T 1-146.

Shut-off approved.

## Amalgamated Oil Co.

Hualde Well No. 2, shut off. T 1-20.

Shut-off approved.

Hualde Well No. 5, commence drilling. P 1-192.

Proposed shut-off depth approved.

Hualde Well No. 5, shut off. T 1-154.

Shut-off approved.

Hualde Well No. 9, shut off. T 1-63.

Test of water shut-off approved.

Well No. 23, deepen. P 1-91.

Approved proposal to deepen.

Hualde Well No. 40, abandon. P 1-264.

The abandonment notice received from the company outlined in detail the proposed work of shooting and plugging. The proposal was approved. It was recommended that the company notify the department in order that the placing of cement plugs could be witnessed.

Hualde Well No. 40, test cement plug. T 1-197.

In cleaning out the well the company was able to reach the top of a former cement plug. Approval was given to plug the open hole with cement from this plug up to the shoe of the 6 $\frac{1}{4}$ " casing.

Hualde Well No. 40, test cement plug. T 1-202.

The results of this test showed the company had satisfactorily carried out their proposal under T 1-197.

Hualde Well No. 40, test cement plug. T 1-249.

The company advised that certain shooting and plugging was done following inspection made by the department under T 1-202. The test witnessed to determine setting of cement below the 8 $\frac{1}{4}$ " casing showed that cement did not set properly. Recommended that company clean out the cement to a point below the casing and replug with cement.

## Thomas Strain.

Well No. 1, redrill. P 1-58.

Study of the records indicated that the 6 $\frac{1}{4}$ " casing cemented at a depth of 4000 ft. failed to prevent water above this depth from passing to lower levels in the well. Therefore it was recommended that an effort be made to force cement back of this casing.

Well No. 1, plug bottom. P 1-84.

Before endeavoring to recement the 6 $\frac{1}{4}$ " casing, it was proposed to clean out to bottom, 4202', and plug well by stages in order to definitely locate the water. This proposal was approved. The results of this work finally showed that water was not shut off by the 6 $\frac{1}{4}$ " casing.

## SECTION 24.

## The Petroleum Company.

Gilman Well No. 1, shut off. T 1-28.

The results of a bailing test indicated that water above the first oil sand was not entering this sand. Recommended drilling out the plug and test well.

Gilman Well No. 1, make pumping test. P 1-64.

Approved proposal to make pumping test and a bailing test later if advisable.

## The Petroleum Co.—Continued.

Gilman Well No. 1, shut off. T 1-37.

This test was made to determine the fluid level in the well.

Gilman Well No. 1, cement. P 1-96.

The results of pumping test showed that a comparatively small amount of water was entering the well either through the first or second oil sand. Approved proposal to shut off the first oil sand.

Gilman Well No. 1, shut off. T 1-51.

The results of a bailing test were not conclusive. Approved proposal to drill to original depth and pump well for a further test.

## Amalgamated Oil Company.

Anaheim Well No. 40, shut off. T 1-104.

The results of a production test showed that the plugging of the lower portion of the well did not shut off water. Recommended further repair work.

Anaheim Well No. 41, commence drilling. P 1-55.

The company was advised that the department was constructing a peg model and that recommendations relative to shut-off, after a depth of about 2500' was reached in drilling, would be made.

Anaheim Well No. 42, commence drilling. P 1-189.

Information derived from study of peg model was furnished the company relative to depth at which the first oil zone should be penetrated.

Anaheim Well No. 42, supplementary to drill. P 1-208.

Approved supplementary proposal to cement 10" casing above first oil zone.

Anaheim Well No. 42, shut off. T 1-215.

The results of the test did not afford sufficient information to give final approval. Recommended that company bail all water from well.

Anaheim Well No. 42, shut off. T 1-225.

Shut-off approved.

Anaheim Well No. 56, shut off. T 1-41.

Shut-off approved. A proposal from the company to drill only through the first oil sand and test same by pumping was also approved.

Anaheim Well No. 56, shut off. T 1-107.

Production test made in accordance to Report T 1-41 showed well free from water.

## SECTION 28.

## Union Oil Company.

Bastanchury Well No. 6, supplementary to drill. P 1-251.

The company was advised that it would be satisfactory to the department to drill until oil bearing formations were encountered and shut off above same.

Bastanchury Well No. 6, shut off. T 1-175.

The results of the test showed that water was not shut off.

Bastanchury Well No. 6, supplementary to drill. P 1-310.

The company advised that oil bearing formation had not been encountered in the well. Approval to continue drilling and shut off above first oil bearing formation was given.

T. 3 S., R. 11 W.

## SECTION 4.

## Union Oil Company.

Myer Well No. 3, supplementary to drill. P 1-169.

The company advised that they had considerable mechanical difficulty at this well in making tests and that oil bearing formation had not been encountered. A proposal to continue drilling was approved.

## SECTION 13.

## Standard Oil Company.

Emery Well No. 5, shut off. T 1-4.

A bailing test was witnessed after the lower portion of the well had been plugged. Approved proposal to pump well for further test.

## Standard Oil Co.—Continued.

Emery Well No. 5, continue plugging. P 1-12.

Approved proposal to put in an additional cement plug in lower portion of well and perforate the water string to test reported oil bearing formations formerly shut off.

Emery Well N. 5, abandon. P 1-141.

Approval to abandon was given indicating depths at which shooting and plugging should be done.

Emery Well No. 5, shut off. T 1-80.

A production test was witnessed which showed that well was making a large amount of water and no oil. Approved proposal to do further plugging.

Emery Well No. 5, shut off. T 1-114.

A test was witnessed to determine productiveness of formations formerly shut off. The results of the test indicated the advisability of further plugging towards abandonment.

Emery Well No. 5, test cement plug. T 1-120.

The inspector visited the well to witness certain measurements previous to placing a cement plug in the formation according to former recommendations of the department.

## SECTION 24.

## Standard Oil Co.

Emery Well No. 16, alter casing. P 1-354.

Approved proposal to bridge in oil string below water string and force cement out through perforations above the bridge in an effort to shut off "top" water.

Emery Well No. 29, deepen. P 1-280.

Proposal approved.

Well No. 32, shut off. T 1-6.

The results of the test indicated that water was not shut off. Approved proposal to make further bailing tests.

Emery Well No. 32, supplementary to deepen. P 1-21.

Recommended that company make another attempt to shut off above the first oil sand rather than below it, as proposed.

Emery Well No. 32, deepen. P 1-85.

After considerable discussion and correspondence, approval was given to shut off below the first oil sand following a definite program of mudding and cementing. The company agreed to drill another well and test formation shutoff in this well.

Emery Well No. 32, deepen. P 1-93.

On account of the changed condition of the former water string, additional recommendations were made relative to shooting and plugging the old hole before sidetracking the lower portion of it.

Emery Well No. 32, mudding operations witnessed. T 1-44.

The operations witnessed while the first oil sand was mudded under pressure were recorded in this report.

Emery Well No. 32, mudding and cementing witnessed. T 1-47.

Final mudding and cementing operations were witnessed by a member of the department and covered in this report.

Emery Well No. 32, shut off. T 1-64.

On account of the mixture of water and oil and change in water level it was necessary to witness four tests before final approval of the shut-off was given.

Emery Well No. 33, shut off. T 1-9.

The test was not satisfactory on account of the fact that water was found 500' below depth reported bailed. Approval was given to make further bailing tests.

Emery Well No. 33, shut off. T 1-11.

The results of the test were not conclusive in showing that water was completely shut off. Recommended further bailing tests or production test after completion of well.

## Standard Oil Co.—Continued.

Emery Well No. 33, redrill. P 1-53.

Approved proposal to plug lower portion of well stating that it seemed necessary to plug in stages and test after each plug.

Emery Well No. 33, shut off. T 1-220.

A production test showed well, producing an amount of water which was not considered damaging. Approved further pumping of well.

Emery Well No. 34, commence drilling. P 1-90.

Recommendations were made relative to depth of water shut-off in accordance with former understanding with company to test formations which were shut off in an adjoining well.

Emery Well No. 34, shut off. T 1-125.

The results of this test showed that there was a failure to shut off water or that a water bearing formation had been penetrated immediately below the shoe of the water string.

Emery Well No. 34, deepen. P 1-249.

The proposal to shut off at a lower depth was not approved pending further tests. It was suggested that company plug lower portion of water string and perforate above the plug to determine if water was passing on the outside of this casing.

Emery Well No. 34, shut off. T 1-162.

The suggested work in Report P 1-249 was carried out. Water entered the casing through the perforations and rose to near the surface.

Emery Well No. 34, test. P 1-270.

Approved proposal from the company to force cement out through the perforations in the water string.

McNally Well No. 2, abandon. P 1-9.

Certain plugging had been done in the lower portion of this well previous to the receipt of the abandonment notice. Approval was given to remove the upper portion of 8 $\frac{1}{4}$ " and 10" casings without further plugging.

Well No. 2, supplementary to abandon. P 1-62.

Company converted well into a water well and turned it over to the owners of the land.

**MONTEBELLO FIELD.**

T. 1 S., R. 11 W., S.B.B. & M.

**SECTION 31.**

## Standard Oil Co.

Baldwin Well No. 16, commence drilling. P 1-289.

Approved proposal from company to shut off water about 20' above the first showing of oil.

Baldwin Well No. 16, shut off. T 1-226.

The results of the test were not conclusive, on account of the mixture of water and oil found above the point to which water was bailed. Approved proposal to conduct further tests.

Baldwin No. 16, shut off. T 1-229.

The results of the tests indicated but did not conclusively demonstrate that water was shut off. Approval to continue drilling and make production test was given.

Baldwin Well No. 16, shut off. T 1-231.

The company made further tests which indicated but did not definitely prove that water was shut off. Approved proposal to bail all water from the well and run oil into the well to maintain a fluid level of at least 1200', so as not to endanger the 12 $\frac{1}{4}$ " casing.

Baldwin Well No. 16, shut off. T 1-238.

Shut-off approved.

## General Petroleum Co.

Well No. 1, commence drilling. P 1-171.

The information given in the notice of intention to drill was satisfactory.

Potrero Chico Well No. 1, shut off. T 1-204.

Shut-off not satisfactory. Company proposed cement string of 10" casing.

## Petroleum Midway Co.

Taylor Well No. 1, commence drilling. P 1-240.

Recommended that company shut off water above first oil bearing formation encountered, in order that such formation could be properly tested.

Darlington Well No. 1, commence drilling. P 1-239.

Recommended that company shut off water above the first oil bearing formation penetrated, in order that such formation could be properly tested.

Darlington Well No. 1, supplementary to drill. P 1-279.

The supplementary notice stated that the 12½" casing which had been cemented, collapsed about 650' above the shoe. Approved proposal to cement 10" casing above the first oil bearing formation penetrated in the well.

Darlington Well No. 1, shut off. T 1-222.

Approval of the shut-off was not given on account of the fact that certain oil bearing formations were shut off by the 10" casing without approval of the department, and without demonstration that such formations were protected from water.

## California Star Oil Co.

Well No. 1, commence drilling. P 1-120.

Recommended that company shut off water above first oil bearing formation encountered in order that a proper test could be made. Information relative to neighboring wells was furnished the company.

Well No. 1, supplementary to drill. P 1-215.

Approved supplementary notice to sidetrack certain casing and continue drilling, according to recommendations in decision P 1-120.

## SECTION 32.

## Amalgamated Oil Co.

Durfee Well No. 1, commence drilling. P 1-115.

At the time this decision was written, there was not sufficient information available to indicate the depth at which water should be shut off.

## Cheney Stimson Oil Co.

Well No. 1, commence drilling. P 1-312.

Recommended that the company take samples of formation at certain intervals and shut off above first oil-bearing formation penetrated.

## SECTION 33.

## Union Oil Co.

San Gabriel Well No. 1, commence drilling. P 1-256.

No recommendation as to depth of shut-off was made, except that water should be shut-off above first oil-bearing formation encountered, in order that a proper test could be made.

## SECTION 35.

## Shell Co. of California.

Well No. 1, commence drilling. P 1-219.

The plan by which the company proposed to drill this well was approved.

T. 2 S., R. 11 W., S.B.B.&M.

## SECTION 5.

## Shell Co. of California.

Well No. 1, commence drilling. P 1-372.

The proposed plan of drilling this well was approved. Recommended shut-off above first oil-bearing formation.

**Potter Oil Co. of California.**

Well No. 1, commence drilling. P 1-319.

This decision stated that there was not sufficient information at hand to indicate the depth at which oil-bearing formations should be encountered. Recommended shut-off above first oil-bearing formation penetrated.

**Keeler & Taussig.**

Well No. 1, commence drilling. P 1-350.

Approved proposal outlining the details of plan of drilling this well.

T. 2 S., R. 11 W.

SECTION 6.

**Standard Oil Co.**

Temple Well No. 2, commence drilling. P 1-24.

Approved shut-off depth proposed by the company.

Temple Well No. 2, shut off. T 1-21.

Shut-off approved.

Temple Well No. 3, commence drilling. P 1-60.

Recommended that company shut off water between depths of about 1285' and 1390' in order to test formations immediately below the shut-off point.

Temple Well No. 3, supplementary to drill. P 1-74.

Report No. P 1-60 was supplemented in order to approve proposal from company to shut off about 23' above the first showing of oil which had been penetrated in drilling.

Temple Well No. 3, shut off. T 1-38.

The results of the test indicated but did not conclusively demonstrate that all water was shut off. Approved proposal to continue drilling and make production test about 60 days after completion.

Temple Well No. 3, shut off. T 1-210.

The results of a tank gauge of 19 hours production showed well making no water. Shut-off approved.

Temple Well No. 4, commence drilling. P 1-156.

The proposed shut-off depth was approved.

Temple Well No. 4, shut off. T 1-92.

Water was not shut off. Approved proposal to force cement back of the water string.

Temple Well No. 4, shut off. T 1-119.

A test witnessed after the well had been recemented showed that water was not shut off. Stated that study of peg model indicated that first oil-bearing formation should be penetrated about 300' below present shut-off point. Drilling was resumed.

Temple Well No. 4, shut off. T 1-157.

Shut-off approved.

Temple Well No. 5, commence drilling. P 1-190.

Recommended that company keep department informed relative to character of formations penetrated below a depth of 1150'. Suggested the advisability of drilling till a showing of oil was found before shutting off.

Temple Well No. 5, shut off. T 1-133.

Shut-off approved.

Temple Well No. 6, commence drilling. P 1-313.

Approved proposal to drill to first oil-bearing formation and shut off water above same.

Baldwin Well No. 5, commence drilling. P 1-23.

Proposed shut-off depth approved.

Baldwin Well No. 5, plug below water string. P 1-47.

Approved proposal to plug hole below water string in order to determine source of water entering the well.

Baldwin Well No. 5, make production test. P 1-79.

The company advised that cement plug was put in up to within 5' of shoe of water string and well made 5' of water per hour, and that after 13' of the plug

was cleaned out the well made about 15' of water per hour. Approved proposal to clean out remainder of cement plug and pump well and determine the amounts of oil and water produced per day.

Baldwin Well No. 5, supplementary to drill-cement casing. P 1-117.

Approved proposal to cement 10" casing 40' below 12½" casing and above the oil sand reported near the bottom of the well.

Baldwin Well No. 5, supplementary to drill, alter casing. P 1-125.

The company advised that it would be necessary to shoot off the two lower joints of the 12½" casing. Approved proposal to force cement back of 12½" casing previous to carrying out work formerly approved in Report P 1-117.

Baldwin Well No. 5, shut off. T 1-59.

A test was witnessed to determine the rate at which water entered the well through a leak in the 12½" casing.

Baldwin Well No. 5, shut off. T 1-78.

The results of the test showed that 10" casing which had been cemented, failed to shut off water. Recommended further tests or that company file a new proposal. Baldwin Well No. 5, supplementary to drill. P 1-183.

The company expressed an opinion that water was entering the well from below the 10" casing and that the 10' of oil sand penetrated at the bottom of the well correlated with producing oil sand in adjoining wells. The department recommended that company try and force cement back of the 10" casing before carrying out further work.

Baldwin Well No. 5, shut off. T 1-110.

Circulation was established between the 10" and 12½" casings and well re cemented with 60 sacks of cement. The test showed that water was not shut off. Recommended that company again try for circulation between 10" and 12½" casings. Baldwin Well No. 5, shut off. T 1-159.

Following the above test the entire string of 10" casing was pulled out and subsequently cemented at a point 150' higher than formerly. The results of the test indicated that water from above the shut-off point was prevented from passing to lower levels in the well. Recommended test of formations between shut-off point and original depth drilled.

Baldwin Well No. 5, shut off. T 1-179.

The test showed that water was entering the well when redrilled to within 50' of original depth drilled. It was recommended that the company plug the lower portion of the redrilled hole in order to locate the source of the water.

Baldwin Well No. 5, shut off. T 1-199.

An 80' plug decreased the rate at which water was entering the well. Further plugging was suggested but not required.

Baldwin Well No. 5, shut off. T 1-206.

A representative of the department visited the well to note the showing of oil encountered 12' below the former depth drilled. Specifications for mudding upper formation and approval to shut off immediately above the last showing of oil was given.

Baldwin Well No. 5, shut off. T 1-237.

Shut-off approved.

Baldwin Well No. 15, commence drilling. P 1-300.

Approved proposal to shut off water above first oil-bearing formation.

Baldwin Well No. 15, shut off. T 1-230.

The results of the test showed that a complete shut-off had not been effected. Approval to plug below and up into water string and make casing test was given. Baldwin Well No. 15, supplementary to drill. P 1-375.

Approved proposal to clean out to original depth drilled and test by pumping or bailing to determine amount of oil well would produce.

Baldwin Well No. 19, commence drilling. P 1-342.

Approved proposal to drill to first showing of oil and shut off water above same.

## Standard Oil Co.—Continued.

Baldwin Well No. 10, supplementary to drill. P 1-370.

The company reported that well had been drilled 100' below depth at which oil had been expected. Approved proposal to continue drilling till oil was encountered and then shut off above the oil.

## Petroleum Midway Company, Ltd.

Prugh Well No. 1, commence drilling. P 1-41.

At the time this decision was written there was not sufficient data at hand to indicate the depth at which water should be shut off.

Prugh Well No. 1, supplementary to drill. P 1-69.

Approved proposal to shut off water at depth given in the supplementary notice. Prugh Well No. 1, shut off. T 1-36.

10" casing landed in formation did not make a complete shut-off.

Prugh Well No. 1, supplementary to drill. P 1-94.

Approved proposal to drill to oil-bearing formation and cement either 8½" or 10" casing above same.

Prugh Well No. 1, supplementary to drill. P 1-139.

10" casing was cemented 32' above the first oil sand penetrated. Approved proposal to plug between oil sand and shoe of 10" casing and in case water was found to be entering well to cement 8½" casing immediately above the oil sand.

Prugh Well No. 1, shut off. T 1-109.

This test was witnessed to locate the shoe of the 8½" casing.

Prugh Well No. 1, supplementary to drill. P 1-216.

Approved proposal to force mud into the oil sand, which had been penetrated 24', and then make an effort to force cement back of the water string in order to shut off water.

Prugh Well No. 2, commence drilling. P 1-225.

Recommended that company shut off water above the first oil-bearing formation penetrated.

Prugh Well No. 2, shut off. T 1-166.

The results of the test showed that water from above the shut-off point had been prevented from passing to lower levels in the well. Approval to continue drilling was given. Called attention of company to possibility that oil-bearing formations had been shut off.

Prugh Well No. 3, commence drilling. P 1-359.

Recommended that company shut off water above first oil-bearing formation penetrated and that company secure samples of formation at certain intervals in drilling between a given depth and the shut-off point.

Piuma Briano Well No. 1, commence drilling. P 1-211.

At the time this decision was written there was not sufficient information at hand to indicate the depth at which oil-bearing formation should be penetrated. Recommend shut-off above first oil-bearing formation.

P. & B. Well No. 1, shut off. T 1-178.

Shut-off approved.

P. & B. Well No. 1, supplementary to drill. P 1-361.

Recommended that company plug the well in 50' instead of 100' stages as proposed. The work of plugging to begin at the bottom of the well.

Piuma Briano Well No. 2, commence drilling. P 1-345.

The company stated that they were unable to furnish an estimate of depth at which oil should be found or water shut off. The department recommended that the company shut off above the first oil-bearing formation penetrated.

Walters Well No. 1, commence drilling. P 1-316.

This decision was similar to P 1-345.

## Red Star Petroleum Company.

Well No. 1, commence drilling. P 1-28.

The company proposed to shut off water at a depth of 1350'. It was unanimously agreed at a conference of officials of the Red Star Petroleum Company with

representatives of adjoining companies and the deputy supervisor that it would be advisable to cement at a depth of about 1500' and test reported oil-bearing formations which had been encountered below this depth.

Well No. 1, supplementary to drill. P 1-67.

The company advised that water was found to be entering the well after cleaning out 10' below the shoe of the water string and that subsequent tests convinced them that the reported oil sands did not carry oil.

Well No. 1, supplementary to drill. P 1-71.

Approved a proposal to cement 8 $\frac{1}{4}$ " casing above a showing of oil reported 195' below the 10" casing.

Well No. 1, shut off. T 1-33.

Shut-off approved.

Well No. 2, commence drilling. P 1-153.

The company advised that they were unable to furnish an estimate of depth to oil-bearing formation or depth at which water should be shut off. The department recommended that the company shut off water above first formation found to carry oil.

Well No. 2, shut off. T 1-97.

The results of a test witnessed by the department showed that 181' of water and no oil entered the well in 13 $\frac{1}{2}$  hours. At the time of this test a plug, probably formation, was found 6' above the shoe of the water string. Approved proposal from company to put in 10" casing, clean out below the water string and make a further bailing test.

Well No. 2, shut off. T 1-103.

The results of this test showed that the 12 $\frac{1}{2}$ " casing failed to prevent water from entering the well. The source of the water was not determined. The log showed that oil-bearing formations had not been encountered. Approved proposal to continue drilling. Recommended that company shut off water above first oil-bearing formation encountered in drilling.

Well No. 2, supplementary to drill. P 1-259.

Approved a proposal to cement 10" casing about 150' above the depth to which the well had been drilled. The company filed this proposal after a conference had been held with the department.

Well No. 3, commence drilling. P 1-178.

Recommended that company shut off water above first oil-bearing formation encountered.

Well No. 3, shut off. T 1-129.

Shut-off approved.

Baldwin No. 4, commence drilling. P 1-344.

The company proposed to shut off water at a depth of about 1800'. Recommended that company shut off water above first oil-bearing formation encountered and that samples of formation should be secured about every 10' beginning at a depth of about 1450'.

Baldwin Well No. 5, commence drilling. P 1-346.

The company advised that they were unable to estimate the depth at which oil-bearing formation should be encountered or depth at which water should be shut off. The department recommended that the company shut off water above the first oil-bearing formation penetrated.

W. T. McGinley.

Well No. 1, commence drilling. P 1-175.

Proposed shut-off depth approved.

Well No. 1, shut off. T 1-94.

Shut-off approved.

Well No. 1, supplementary to drill. P 1-208.

Approved proposal to drill to a specified depth and test well by pumping for a certain period of time. Attention was called to the possibility of water-bearing

formations between shut-off point and first oil-bearing formation which had been penetrated.

Well No. 1, shut off. T 1-138.

The production test witnessed failed to show that water had been satisfactorily shut off. Recommended that company take necessary steps to repair the well.

Well No. 2, commence drilling. P 1-253.

Recommended shut-off above first oil-bearing formation penetrated.

Well No. 2, supplementary to drill. P 1-267.

A representative visited the well to witness the first showing of oil reported. Approved shut-off depth given in the supplementary notice.

Well No. 2, shut off. T 1-181.

Shut-off approved.

Well No. 3, commence drilling. P 1-335.

Recommended shut off above first oil-bearing formation penetrated and that company secure samples of formation from rotary ditch or bit about every 10' between a specified depth and shut-off point.

Well No. 3, supplementary to drill. P 1-349.

Approved proposed depth of water shut-off given in supplementary notice.

#### General Petroleum Company.

Cruz Well No. 1, commence drilling. P 1-318.

Recommended that company shut off water above first oil-bearing formation encountered in the well. The company was furnished with the depth at which the department estimated that oil-bearing formation should be found.

#### California Star Oil Company.

Nutt Well No. 1, commence drilling. P 1-237.

Recommended that the company shut off water above first oil-bearing formation penetrated in the well.

#### St. Helens Petroleum Company.

Well No. 1, commence drilling. P 1-363.

At the time this decision was written there were not sufficient data at hand to indicate the depth at which oil-bearing formation should be encountered. Recommended that company shut off water above first oil-bearing formation penetrated in the well.

#### Doheny-Pacific Petroleum Company.

Well No. 1, commence drilling. P 1-376.

Recommended that company shut off water above first oil-bearing formation penetrated in the well.

T. 1 S., R. 12 W.

#### SECTION 33.

#### Pan-American Petroleum Company.

Hellman Well No. 1, commence drilling. P 1-152.

Recommended that company shut off water above first formation, which was found to carry oil.

#### SECTION 35.

#### Pan-American Petroleum Company.

Tri-City Well No. 1, commence drilling. P 1-100.

There was not sufficient information at hand to indicate the depth at which water should be shut off. Recommended that company shut off water above the first oil-bearing formation penetrated in order that a proper test could be made.

Tri-City Well No. 1, supplementary to drill. P 1-170.

The company advised that the 12½" casing failed to shut off water. A proposal from the company to attempt to force cement back of this casing was approved. Tri-City Well No. 1, supplementary to drill. P 1-191.

Approved proposal from company to put in 10" casing and drill well several feet deeper and make further tests relative to reported showing of oil. The

department advised that such a test probably could not be satisfactorily made unless water above the sand was shut off.

Tri-City Well No. 1, shut off. T 1-82.

The results of the test showed that water was not shut off. Recommended that company determine the source of the water if possible.

Tri-City Well No. 1, supplementary to drill. P 1-195.

Approved proposal from the company to plug below the 12 $\frac{1}{2}$ " casing to determine whether or not water was entering the well from back of this casing. It was the understanding of the department that the Riverside Portland Cement Company and the Baldwin Stocker Oil Estate, neighboring companies, agreed to pay the cost of this work.

Pan-American Petroleum Company.

Tri-City Well No. 1, shut off. T 1-96.

Upon request of the company the deputy supervisor was present at this well to witness the placing of a cement plug below the 12 $\frac{1}{2}$ " casing.

Tri-City Well No. 1, shut off. T 1-112.

It was decided at a conference of neighboring operators with a representative of the company to put in additional cement. A proposal to do this was approved by the department.

Tri-City Well No. 1 test. P 1-246.

Approved proposal from the company to conduct certain bailing tests before and after drilling out the cement plug below the 12 $\frac{1}{2}$ " casing.

Tri-City Well No. 1, shut off. T 1-147.

The results of bailing tests showed that the 12 $\frac{1}{2}$ " casing failed to prevent water above the shut-off point from entering the well. Bailing tests made after the cement plug was drilled out indicated the possibility that water-bearing formation had been penetrated near the bottom of the well. Approval to continue drilling was given.

Rice Ranch Oil Company.

Well No. 1, commence drilling. P 1-151.

Recommended that the company shut off water above first oil-bearing formation penetrated in the well.

Well No. 1, shut off. T 1-152.

The results of the test showed that water was not shut off.

Well No. 1, supplementary to drill. P 1-261.

Approved proposal to continue drilling until a showing of oil was found and shut off water above same.

Well No. 1, shut off. T 1-244.

Shut-off approved.

Union Oil Company.

Valley View Well No. 1, commence drilling. P 1-150.

No recommendations relative to depth of water shut-off were made except that shut-off should be made above formation found to carry oil.

Baldwin-Stocker Oil Estates.

Well No. 3, commence drilling. P 1-197.

There was not sufficient information at hand when this decision was written to indicate the depth at which oil-bearing formation should be encountered.

#### SECTION 36.

Amalgamated Oil Co.

Connor Well No. 1, commence drilling. P 1-196.

Recommended shut-off above formation found to carry oil.

Connor Well No. 1, redrill. P 1-254.

Approved proposal to move derrick and rig and drill a second hole. No plugging was required in the first hole.

## Amalgamated Oil Co.—Continued.

Connor Well No. 1, supplementary to drill. P 1-322.

Approved proposal to cement 12½" casing at a depth of about 2150'.

Connor Well No. 1, supplementary to drill. P 1-358.

Approved proposal to continue drilling with 10" casing and shut off water above first oil-bearing formation penetrated.

## California Star Oil Co.

Comte Well No. 1, commence drilling. P 1-238.

Recommended shut-off above first oil-bearing formation penetrated in the well.

T. 2 S., R. 12 W., S.B.B. & M.

## SECTION 1.

## Standard Oil Co.

Baldwin Well No. 2, shut off. T 1-2.

Shut-off approved.

Baldwin Well No. 3, shut off. T 1-3.

Shut-off approved.

Baldwin Well No. 6, commence drilling. P 1-44.

Proposed shut-off depth approved.

Baldwin Well No. 6, shut off. T 1-31.

On account of the mixture of oil and water, three bailing tests were witnessed. The results of the last test indicated but did not definitely demonstrate that water was shut off. Approved proposal to complete well and make production test.

Baldwin Well No. 7, commence drilling. P 1-292.

Approved proposed shut-off depth.

Baldwin Well No. 7, shut off. T 1-239.

The results of the test did not conclusively prove that water was shut off. Approved proposal from company to make further tests.

Baldwin No. 7, shut off. T 1-243.

Test of water-shut was approved after hole had been cleaned out below the shoe of the water string and two additional tests witnessed.

Baldwin Well No. 8, commence drilling. P 1-80.

Approved proposed shut-off depth.

Baldwin Well No. 8, supplementary to drill. P 1-129.

After drilling into the oil sand the company filed a supplementary notice changing the original proposed shut-off point. The new proposal was approved.

Baldwin Well No. 8, shut off. T 1-58.

The results of two bailing tests witnessed by the department were not conclusive, in showing that water was shut off. Further tests were suggested.

Baldwin Well No. 8, supplementary to drill. P 1-164.

Approved proposal to bridge portion of well and attempt to force cement back of water string.

Baldwin Well No. 8, shut off. T 1-79.

The results of the test showed that water was not shut off. Recommended re-cementing or shut-off with another string of casing.

Baldwin Well No. 8, shut off. T 1-105.

The water string was recemented. The results of test showed that water was not shut off. Approved proposal to again recement.

Baldwin Well No. 8, shut off. T 1-123.

The results of test indicated that water was not shut off. Recommended further tests or that company file a proposal covering further work.

Baldwin Well No. 8, supplementary to drill. P 1-235.

Approved proposal to shut off lower joint of 12½" casing and cement 10" casing above the oil sand.

Standard Oil Co.—Continued.

Baldwin Well No. 8, shut off. T 1-150.

The results of the bailing test indicated that water was shut off. Approval to continue drilling was given. Recommended production test 30 days after completion.

Baldwin Well No. 9, commence drilling. P 1-107.

Approved proposed shut-off depth.

Baldwin Well No. 9, shut off. T 1-53.

The results of the test indicated that a complete shut-off had not been made. Oil stood at the surface when the test was witnessed. Approved proposal to make further tests.

Baldwin Well No. 9, supplementary to drill. P 1-163.

Approved proposal to bridge below and force cement back of the 12½" casing.

Baldwin Well No. 9, shut off. T 1-93.

The results of the test showed water was not shut off. Approved proposal to recement the 12½" casing.

Baldwin Well No. 9, shut off. T 1-118.

The results of the test showed that water was not shut off.

Baldwin Well No. 9, supplementary to drill. P 1-244.

Approved proposal to cement 10" casing above the oil sand which had been penetrated.

Baldwin Well No. 9, shut off. T 1-167.

The results of the test showed that water was not shut off. Approved proposal to force cement back of the 10" casing.

Baldwin Well No. 9, shut off. T 1-216.

The results of the test showed that water was not shut off.

Baldwin Well No. 9, plug and alter casing. P 1-331.

Approved proposal to put a 10' plug of cement in the lower part of the 10" casing, rip the casing above the plug and force cement out through the 10" casing.

Baldwin Well No. 9, shut off. T 1-227.

This test was witnessed at the suggestion of the company. The test showed that the cement plug in the lower part of the 10" casing prevented water from entering through the bottom of this casing.

Baldwin Well No. 9, shut off. T 1-232.

This test was witnessed at the suggestion of the company. The results of the test showed that a small amount of water entered the 10" casing, probably through the perforations above the cement plug.

Baldwin Well No. 10, commence drilling. P 1-106.

Proposed shut-off depth approved.

Baldwin Well No. 10, recement. P 1-168.

Approved proposal to force cement back of the 12½" casing.

Baldwin Well No. 10, deepen and recement. P 1-177.

Approved to cement 10" casing above the first showing of oil encountered in the well.

Baldwin Well No. 10, shut off. T 1-136.

The results of the test showed that water was not shut off.

Baldwin Well No. 10, recement. P 1-263.

Approved proposal to force cement back of the 10" casing.

Baldwin Well No. 10, shut off. T 1-165.

The results of the test showed that water was not shut off.

Baldwin Well No. 10, recement. P 1-283.

Approved proposal to cement 8½" casing at the depth given in the supplementary notice.

Baldwin Well No. 10, shut off. T 1-195.

Shut-off approved.

Baldwin Well No. 10, plug. P 1-353.

Approved proposal to plug a certain part of the lower portion of the well.

## Standard Oil Co.—Continued.

Baldwin Well No. 11, commence drilling. P 1-134.

Approved proposed shut-off depth.

Baldwin Well No. 11, shut off. T 1-72.

Shut-off approved.

Baldwin Well No. 11, plug and alter casing. P 1-260.

Recommended certain shooting and plugging in the lower part of the well. Approved proposal to cement 10" casing in case water was found to be entering the well from above the oil sand.

Baldwin Well No. 11, shut off. T 1-174.

This test was witnessed to determine the fluid level, after certain plugging had been done, previous to cementing the 10" casing.

Baldwin Well No. 11, shut off. T 1-212.

Shut-off approved.

Baldwin Well No. 12, commence drilling. P 1-190.

Approved proposed shut-off depth.

Baldwin Well No. 12, redrill. P 1-348.

Approved proposal to move derrick and drill a second hole. No plugging was required in the first hole on account of the fact that this hole had not been drilled deep enough to penetrate oil-bearing formation.

Baldwin Well No. 13, commence drilling. P 1-257.

Approved proposed shut-off depth.

Baldwin Well No. 13, shut off. T 1-205.

Shut-off approved.

Baldwin Well No. 14, commenced drilling. P 1-285.

Approved proposed shut-off depth.

Baldwin Well No. 17, commence drilling. P 1-325.

Approved proposed shut-off depth. Recommended that company take samples of formation about every 10' between a certain depth and the shut-off point.

Baldwin Well No. 18, commence drilling. P 1-334.

Approved proposed shut-off depth.

## Union Oil Company.

La Merced Well No. 1, shut off. T 1-26.

Well passed for production test.

La Merced Well No. 1, shut off. T 1-240.

Shut-off approved.

La Merced Well No. 2, supplementary to drill. P 1-258.

Cement forced back of a string of casing which "froze," failed to shut off water. Approved proposal to continue drilling and cement casing above first oil sand.

La Merced Well No. 2, shut off. T 1-196.

Shut-off approved.

La Merced Well No. 3, shut off. T 1-86.

The test witnessed was not conclusive in showing that water was shut off. Further bailing tests were recommended.

La Merced Well No. 3, shut off. T 1-91.

The results of the last of several tests indicated but did not conclusively show that water was shut off. Approved proposal to drill about 350' below shut-off point and make production test after completion.

La Merced Well No. 3, continue drilling. P 1-234.

Approved supplementary proposal to continue drilling below depth proposed by the company and approved in decision No. P 1-91.

La Merced Well No. 3, shut off. T 1-236.

Approval of test of water shut-off was not given. Recommend that company continue pumping pending further developments in the territory. Requested chemical analysis of water produced by the well.

Well No. 4, commence drilling. P 1-123.

Proposed shut-off depth approved.

## Union Oil Company—Continued.

Well No. 4, shut off. T 1-102.

Shut-off approved.

Well No. 4, supplementary to drill. P 1-338.

Approved proposal to cut off oil string and set a packer near the shoe of the water string.

Well No. 4, test. P 1-366.

Approved proposal to continue pumping in an effort to diminish the water produced by the well.

La Merced Well No. 5, commence drilling. P 1-102.

Recommended shut-off at same stratigraphic depths as Well No. 1, in which shut-off was made above the first oil sand penetrated.

La Merced Well No. 5, supplementary to drill. P 1-131.

A proposal to drill below depth furnished by the company in the original notice was approved. Suggested drilling only to a specified depth before shutting off water.

La Merced Well No. 5, shut off. T 1-69.

Oil stood 40' from the surface at time of the test. Approval to continue drilling was given with a production test to be witnessed after completion.

La Merced Well No. 5, shut off. T 1-241.

Water shut-off was approved after a production test was witnessed.

La Merced Well No. 6, commence drilling. P 1-155.

Proposed shut-off depth was approved.

La Merced Well No. 6, shut off. T 1-108.

Shut-off approved.

La Merced Well No. 9, commence drilling. P 1-324.

At the time the decision was written there was not sufficient information at hand to indicate the depth at which oil-bearing formation should be encountered. Recommended shut-off above first oil-bearing formation penetrated.

La Merced Well No. 10, commence drilling. P 1-323.

A decision similar to one for Well No. 9 was written for this well.

## Petroleum Midway Company.

Germain Well No. 1, commence drilling. P 1-212.

Recommended shut-off above first oil-bearing formation penetrated in the well.

Germain Well No. 1, shut off. T 1-224.

The results of the test showed that water was not shut off. Suggested that the company force mud into the sand below the water string and make an effort to recement the 10" casing.

## SECTION 2.

## Standard Oil Company.

Baldwin Well No. 4, supplementary to drill. P 1-61.

Recommended that the company cement 10' lower than proposed in the supplementary notice.

Baldwin Well No. 4, test. P 1-126.

Approved proposal from the company to cement 8½" casing below the sand penetrated under the 10" casing, providing certain tests showed that this sand was not oil bearing.

Baldwin Well No. 4, recement. P 1-136.

Report No. P 1-126 was superseded after the department obtained additional information relative to the sand penetrated below the 10" casing.

Recommended that company shut off water above this sand.

Baldwin Well No. 4, supplementary to drill. P 1-161.

Approved proposal to shut off in shale "break" reported found in sand penetrated below the 10" casing. Specifications for mudding and cementing were given.

Baldwin Well No. 4, alter casing. P 1-162.

Approved proposal to remove the upper portion of the 10" casing.

Baldwin Well No. 4, shut off. T 1-89.

The results of the test indicated that water above the shut-off point had been prevented from passing to lower levels in the well. Approved proposal to clean out formation which had heaved up into the water string and test well for production.

## Standard Oil Co.—Continued.

Baldwin Well No. 4, shut off. T 1-106.

The results of a bailing test for production were not conclusive on account of a sand plug which had heaved up into the water string to a point 630' above the shoe. Approved proposal to clean out and put in an oil string.

Baldwin Well No. 4, shut off. T 1-121.

This completed the test of the productiveness of formations between the shut-off point and depth to which the well was drilled previous to cementing the 12½" casing as the original water string.

Baldwin Well No. 4, plug. P 1-271.

Approved proposal to plug the lower portion of the well, after about 900' had been drilled below the shut-off point.

Baldwin Well No. 20, commence drilling. P 1-364.

Recommended shut-off above first oil-bearing formation penetrated in the well and that samples of formation be taken about every 10' between a given depth and the shut-off point.

## Riverside Portland Cement Company.

Well No. 1, redrill. P 1-52.

Approved proposal to move derrick and drill a second hole. No plugging was required in the first hole.

Well No. 2, commence drilling. P 1-72.

At the time this decision was written there was not sufficient information at hand to indicate the depth at which water should be shut off. Requested weekly copy of the log of the well. Stated that recommendations relative to shut-off depth would be made at a later date.

## Baldwin-Stocker Oil Estates.

Well No. 2, redrill. P 1-87.

Approved proposal to move derrick and drill a second hole. No plugging was required in the first hole.

Well No. 2, shut off. T 1-75.

Shut-off approved.

Well No. 2, supplementary to drill. P 1-252.

Approved proposal to cement 10" casing above first showing of oil encountered.

Well No. 2, shut off. T 1-163.

The results of the test showed that water was not shut off.

Well No. 2, supplementary to drill. P 1-282.

Approved proposal to cement 8½" casing above first showing of oil encountered.

Well No. 2, supplementary to drill. P 1-328.

Approved proposal to put in 6½" casing with the lower joint perforated and make a pumping test. Recommended that company measure the amount of oil and amount of water produced each day.

Well No. 2, shut off. T 1-163.

Test indicated that water was not shut off by the cementing of the 10" casing.

## Petroleum Midway Company.

Howard & Smith Well No. 1, commence drilling. P 1-68.

Approved proposal to drill and recommended that water be shut off above first oil-bearing formation penetrated.

Howard & Smith Well No. 1, supplementary to drill. P 1-278.

Approved proposal to continue drilling in the manner outlined by the company.

Mulholland Well No. 1, commence drilling. P 1-305.

Approved proposal to drill, indicating depths at which samples should be taken, and recommended that the company shut off water above the first oil-bearing formation encountered.

## General Petroleum Company.

Ralph Well No. 1, commence drilling. P 1-287.

The department furnished the company with an estimate of the depth at which oil-bearing formations should be encountered. Recommended shut-off above first oil-bearing formation penetrated.

Ralph Well No. 1, supplementary to drill. P 1-371.

Approved proposal to cement 12½" casing at a given depth.

## Union Oil Company.

La Merced Well No. 8, commence drilling. P 1-306.

Recommended that the company shut off water above first oil-bearing formation penetrated in the well.

## SECTION 3.

## Interstate Oil Company.

Well No. 1, drill. P 1-40.

Approved proposal to shut off water above first oil-bearing formation penetrated in the well.

## Pan-American Petroleum Company.

Bicknell Well No. 1, commence drilling. P 1-101.

Approved proposal, and recommended that the company shut off water above formation found to carry oil.

## WHITTIER FIELD.

T. 2 S., R. 11 W., S.B.B. & M.

## SECTION 8.

## Montebello Mascot Oil Co.

Well No. 1, commence drilling. P 1-207.

Approved proposal to drill. This department to be advised previous to shutting off water, provided an oil-bearing formation has been encountered.

## SECTION 9.

## Montebello Oil Syndicate.

Well No. 1, commence drilling. P 1-224.

Recommended that the company shut off water above oil-bearing formations which may be encountered.

## SECTION 15.

## Central Oil Company of Los Angeles.

Well No. 60, commence drilling. P 1-6.

The company proposed to drill, using three strings of casing, landing 12 $\frac{1}{2}$ " at the estimated depth of top of first productive oil or gas sand and second string at the estimated depth of second sand. Recommended that the company cement and test each string of casing landed in the well below a depth of 500'.

Well No. 60, shut off. T 1-57.

Approved shut-off with 12 $\frac{1}{2}$ " casing.

## SECTION 22.

## Central Oil Company of Los Angeles.

Well No. 31B, shut off. T 1-15.

Shut-off approved.

Well No. 46, deepen. P 1-38.

The proposal to deepen as outlined in the notice was approved.

Well No. 59, commence drilling. P 1-112.

The proposal to drill this well as outlined in the notice, supplemented by the verbal proposal of the superintendent was approved.

## Standard Oil Company.

Savage Well No. 12, deepen. P 1-7.

The proposal to deepen was approved.

Savage Well No. 12, supplementary to deepen. P 1-46.

Approved proposal to cement 6 $\frac{1}{4}$ " casing at the depth given in the notice, suggested that the company force mud into the oil and water sands above the proposed shut-off point and use sufficient cement to reach the shoe of the 8 $\frac{1}{4}$ " casing.

Savage Well No. 12, recement. P 1-158.

Approved proposal to force cement back of the 6 $\frac{1}{4}$ " casing.

Savage Well No. 12, shut off. T 1-84.

The results of the test showed that water was probably not shut off, suggested further bailing tests.

Savage Well No. 12, recement. P 1-194.

Approved proposal to force cement back of the 6 $\frac{1}{4}$ " casing.

## Standard Oil Co.—Continued.

Savage Well No. 12, shut off. T 1-128.

The results of the test showed that water was not shut off.

Savage Well No. 12, alter casing. P 1-243.

Approved proposal to plug the lower portion of the well and rip or shoot the 6½" casing and cement a new string of 6½" casing at about the same depth as formerly cemented.

Savage Well No. 12, shut off. T 1-252.

The results of the test showed that water was not shut off. Approved proposal to recement the 6½" casing.

Savage Well No. 14, shut off. T 1-7.

The results of the test showed that water above the shut-off point was not passing to lower levels in the well. Attention of the company was called to recommendation in a former report relative to the use of mud in drilling this well. Savage Well No. 14, supplementary to drill. P 1-130.

Approved proposal to continue drilling and shut off water above first oil-bearing formation penetrated below the former shut-off point.

Savage Well No. 14, shut off. T 1-124.

A representative of the department witnessed the measurement of the depth of the well previous to plugging the lower portion. The department was not notified to witness a test of water shut off with the 10" casing.

Savage Well No. 14, plug. P 1-236.

Approved proposal to plug the lower portion of the well in stages of from 50 to 60 feet.

Savage Well No. 14, shut off. T 1-148.

The result of a test and study of data furnished by the company indicated that the plugging work approved in P 1-236 was satisfactorily done.

Savage Well No. 15, commence drilling. P 1-290.

Approved proposal to cement 15½" casing above the first oil zone providing the zone was encountered above a certain depth.

Savage Well No. 15, supplementary to drill. P 1-341.

A conditional approval to land 15½" casing with heavy mud back of it instead of cement, to protect certain oil formations passed through, was given.

Savage Well No. 15, shut off. T 1-251.

The results of test showed that any water above the shut-off point was not passing to lower levels in the well.

Savage Well No. 16, commence drilling. P 1-33.

Recommended that the company shut off water between certain depths in order to protect an oil zone from which adjoining wells were producing. The attention of the company was directed to the protection of other oil sands which the well would probably penetrate.

Savage Well No. 16, shut off. T 1-62.

Shut-off approved.

Savage Well No. 16, plug. P 1-321.

Approved proposal to plug the lower portion of the well as outlined by the company.

## Home Oil Co.

Well No. 12, deepen. P 1-36.

Approved proposal to deepen.

Well No. 19, redrill. P 1-1.

Recommended that the company plug the bottom of the well, indicating the depth at which plugging should be done.

## SECTION 23.

## Central Oil Company of Los Angeles.

Well No. 17B, deepen. P 1-110.

Approved proposal to deepen.

Well No. 18A, deepen. P 1-27.

Approved proposal to deepen in the manner outlined in the notice.

Central Oil Co. of Los Angeles—Continued.

Well No. 29A, abandon. P 1-104.

Requested additional information as to the production of neighboring wells, and also information relative to sidetracked casing in the lower portion of the well.

Well No. 29A, supplementary to abandon. P 1-121.

Approved proposal to abandon, specifying redrilling, shooting and plugging operations necessary.

Well No. 32C, deepen. P 1-26.

Approved proposal to deepen in the manner outlined by the company.

Well No. 61, commence drilling. P 1-133.

Approved proposal to drill indicating probable depth at which oil-bearing formations should be penetrated.

#### SECTION 25.

Standard Oil Company.

M/W Well No. 53, commence drilling. P 1-122.

Approved proposal to drill in the manner outlined by the company.

M/W Well No. 53, shut off. T 1-131.

Water was not shut off by the 12 $\frac{1}{2}$ " casing, which collapsed. The company filed a supplementary proposal covering further work at the well.

M/W Well No. 53, supplementary to drill. P 1-247.

Approved proposal to shut off water with 10" casing at a depth as stated in original notice of intention to drill.

M/W Well No. 53, shut off. T 1-170.

Results of the test not conclusive. Recommended that the company drill the well so that a production test could be made of the first oil sand.

M/W Well No. 53, shut off. T 1-211.

Production test showed that the well produced considerable water. The company planned to continue producing from first oil zone. Recommended that the company notify the department when ready to make a second production test.

Fullerton Oil Co.

Well No. 1, deepen. P 1-193.

Approved proposal to deepen and prospect for lower oil-bearing formations.

Well No. 1, deepen. P 1-343.

Approved proposal to mud up first oil zone under pressure and cement a string of casing above second oil zone and produce from this zone.

Well No. 1, shut off. T 1-246.

Test of water shut off with 10" casing satisfactory.

Well No. 4, commence drilling. P 1-327.

Approved proposal, giving estimated depth at which water should be shut off.

#### SECTION 26.

Standard Oil Co.

M/W Well No. 35, redrill. P 1-272.

Recommended certain ripping and plugging operations with pumping and fluid level tests to determine effectiveness of plugging. Advised delay of work at this well until certain information might be obtained from mudding and cementing operations at Well No. 36.

M/W Well No. 36, redrill. P 1-248.

Approval of proposal withheld pending further information. Recommended that the company furnish detailed outline of their plan to mud formations between the bottom of the 10" and the cementing point of the 8 $\frac{1}{4}$ " casing, with estimated depth at which 8 $\frac{1}{4}$ " casing would be cemented.

M/W Well No. 36, supplementary to redrill. P 1-275.

Approved proposal to shut off the second oil zone. The department furnished the company with a detailed list of specifications of mudding the second oil zone and cementing casing below this zone in order that the third zone may be tested for production.

M/W Well No. 36, shut off. T 1-185.

Fluid level test was witnessed and a record of fluid level tests, as made by the company, obtained.

Standard Oil Co. Continued.

M/W Well No. 37, redrill. P 1-273.

Recommendations covering work necessary towards mudding and shutting off first oil zone in order that production of clean oil could be obtained from the second oil zone, were made. These recommendations were worked out and agreed upon with officials of the company.

M/W Well No. 41, redrill. P 1-274.

The proposal to redrill was approved. The department recommended certain shooting and plugging operations in the lower portion of the well. A test of the effectiveness of the shut-off of the 6 $\frac{1}{4}$ " casing in preventing water from above the third oil zone from passing to lower levels in the well was also made. The attention of the company was directed to the fact that the first and second oil zones in this well probably had not been protected from water.

M/W Well No. 41, supplementary to redrill. P 1-374.

Upon advice from the company that two strings of tools were lost in the lower portion of the well, certain changes in former recommendations were made relative to shooting and plugging.

M/W Well No. 42, shut off. T 1-1.

Test of water shut-off satisfactory.

M/W Well No. 47, shut off. T 1-10.

Results of the test indicates that water above the shut-off point was not passing to lower levels in the well. The second oil zone was shut off. Shut-off depth not approved.

M/W Well No. 48, shut off. T 1-25.

Test of water shut-off satisfactory.

M/W Well No. 49, shut off. T 1-14.

Test of water shut-off satisfactory.

M/W Well No. 49, shut off. T 1-56.

Shut-off approved.

M/W Well No. 50, supplementary to drill. P 1-22.

A recommendation supplementing a former decision relative to shut-off depth was made.

M/W Well No. 50, shut off. T 1-45.

Tests as reported by the company and those witnessed by the department indicated that water was probably shut off by 10" casing which has been recemented three times.

M/W Well No. 50, shut off. T 1-50.

Tests indicates that water was shut off by cementing of 10" casing, but that water was encountered between the shoe of the 10" casing and the bottom of the well. Recommended certain plugging and testing operations.

M/W Well No. 50, supplementary to drill. P 1-147.

Approved proposal to produce from second oil zone without producing from the first zone, providing each oil zone penetrated was protected from water. Recommended that the company thoroughly mud the well under pressure between the shut-off point above the second zone and the shoe of the 10" and cement the 8 $\frac{1}{4}$ " with sufficient cement to reach up to the shoe of the 10".

M/W Well No. 50, supplementary to drill. P 1-172.

Approved proposed depth of cementing 8 $\frac{1}{4}$ " casing.

M/W Well No. 50, shut off. T 1-76.

The company had prepared 215 cubic feet of mud-laden fluid, or an amount sufficient to fill about 30% of the 8 $\frac{1}{4}$ " water string. When the inspector visited the well to witness the mudding and cementing operations, it was found necessary to hold a pressure on the cement while it was in the 8 $\frac{1}{4}$ " casing in order to force mud into the formations. It would not have been necessary to do this if an amount of mud-laden fluid sufficient to fill the 8 $\frac{1}{4}$ " casing was available.

M/W Well No. 50, shut off. T 1-98.

Shut-off approved.

M/W Well No. 51, drill. P 1-20.

Approved proposal to drill, indicating depth at which water should be shut off.

Standard Oil Co.—Continued.

M/W Well No. 51, shut off. T 1-54.

Test unsatisfactory. Recommended that the company make further bailing or pumping tests to determine the amounts of oil and water entering the well and, if possible, the source of the water.

M/W Well No. 51, shut off. T 1-100.

Production test showed well to be producing a large percentage of water and emulsion. Approved oral proposal of company to clean out to original bottom, put in oil string and make further production test.

M/W Well No. 51, deepen. P 1-329.

Approved proposal to deepen and shut off the first oil zone. The department stated in this decision that the source of the water entering the well at that time was undetermined and that there was some doubt as to the effectiveness of the plan proposed by the company of mudding and cementing the well to exclude water from the first oil zone. Recommended that the company endeavor, in drilling, to locate probable water between the first and second oil zones; also specified requirements additional to those proposed by the company for the mudding and cementing operations.

M/W Well No. 52, commence drilling. P 1-65.

Proposed shut-off depth approved.

M/W Well No. 52, shut off. T 1-52.

Test of water shut-off unsatisfactory. Approved the oral proposal of the company to pump the well for a further test.

M/W Well No. 52, shut off. T 1-99.

Pumping test showed that the well produced considerable water and emulsion. Approved the oral proposal of the company to clean out to original bottom, put in an oil string and make further test of the well.

M/W Well No. 52, deepen. P 1-330.

Approved proposal to deepen. A decision similar to one for well No. M/W 51 written for this well.

M/W Well No. 54, commence drilling. P 1-128.

Approved proposal to drill indicating depths at which water should be shut off above first and second oil zones. Recommended that tests be made to locate probable water between the first and second oil zones.

M/W Well No. 54, shut off. T 1-151.

A test of shut-off with 12½" casing used as conductor casing was approved.

M/W Well No. 54, shut off. T 1-173.

10" casing was cemented above the first oil zone. The test of shut-off was unsatisfactory. Approved proposal to recement 10" casing at same depth.

M/W Well No. 54, shut off. T 1-213.

The test was unsatisfactory. Chemical analysis of water taken from the well before and after cementing the 10" casing indicate such waters to be different. The reports of bailing operations as conducted by the company show that small but constant amounts of oil and water entered the well.

M/W Well No. 54, deepen. P 1-332.

Approved proposal from the company to mud up and shut off the first oil zone and produce from the second zone. The attention of the company was called to the fact that the source of water entering the first zone had not been determined.

M/W Well No. 55, commence drilling. P 1-182.

Approved proposed depth for shutting off water.

M/W Well No. 55, shut off. T 1-191.

Test of water shut-off unsatisfactory. Approved oral proposal to recement at same depth.

M/W Well No. 55, shut off. T 1-217.

Test of water shut-off unsatisfactory. Recommended that the company take such steps as were necessary to protect oil-bearing formations below shut-off point.

M/W Well No. 56, commence drilling. P 1-181.

Approved proposal to drill, giving estimated depth at which water should be shut off.

## Standard Oil Co.—Continued.

M/W Well No. 57, commence drilling. P 1-179.

Approved proposed depth for shutting off water.

M/W Well No. 57, shut off. T 1-184.

Test of water shut off unsatisfactory. Recommended that company make further bailing tests or take steps necessary to secure a shut-off.

M/W Well No. 57, shut off. T 1-221.

Test unsatisfactory. Recommended that the company file a written proposal covering necessary work at the well.

M/W Well No. 58, commence drilling. P 1-352.

Recommended that the company shut off water above the first oil-bearing formation encountered in the well below a depth of about 1900'.

M/W Well No. 59, commence drilling. P 1-336.

Recommended that the company shut off water above first oil-bearing formations encountered below a depth of about 1900'.

## SALT LAKE FIELD.

T. 1 S., R. 14 W., S.B.B. & M.

## SECTION 15.

## Rancho La Brea Oil Co.

Well No. 41, shut off. T 1-141.

This well was deepened into a water sand below former producing oil sands. The production of adjoining wells indicated that damage from this well was ensuing. Several attempts made to plug the lower portion of the well failed to shut off the water. The department recommended that the company force mud-laden fluid into the water sand. The results of a subsequent test indicated that water was not entering the oil sands at this well. This was further borne out by the increase in the production of oil and the decrease in the production of water by neighboring wells.

## SECTION 16.

## Rancho La Brea Oil Co.

Well No. 65, redrill. P 1-304.

The notice to redrill stated that the well was producing 5 bbls. of oil and 100 bbls. of water, and that the company proposed to redrill to shut off water. The company was requested for information relative to plan of work at this well. Well No. 65, supplementary to redrill. P 1-317.

Approved proposal to remove oil string above a depth of 1263' and test out effectiveness of water string. If water string was found to be not effective, to remove same and cement a new water string at a depth of about 1215'.

Well No. 65, shut off. T 1-242.

Test of water shut-off approved.

Well No. 67, deepen. P 1-241.

Approved proposal to shoot and remove as much of the oil string (4½" casing) as possible and deepen to 2300'.

Well No. 68, redrill. P 1-188.

Approved a proposal to redrill this well to original depth on account of oil string being broken off at a depth of 1700'.

## SECTION 20.

## Garbutt Oil Co.

Well No. 11, abandon. P 1-42.

The work of abandonment was not outlined. Recommendations were made giving depths at which shooting and plugging should be done.

Well No. 11, abandon. P 1-70. (Supplementary.)

Approved a proposal to shoot and remove 8½" casing above a depth of about 1140' and use mud-laden fluid in order to redrill and plug the well between depths of 1265' and 1300'.

## Garbutt Oil Co.—Continued.

Well No. 5, supplementary to abandon. P 1-29.

The company proposed to abandon this well. Method of abandonment not outlined. Approval was given with certain recommendations as to shooting and plugging.

Well No. 1, supplementary to abandon. P 1-5.

Approved proposal to continue the work of abandonment of this well in the manner proposed by the company.

## SECTION 28.

## Rancho La Brea Oil Co.

Pitcher & Garbutt Well No. 71, redrill. P 1-56.

Approved a proposal to clean out and test well, and deepen, if necessary.

T. 1 S., R. 15 W., S.B.B. & M.

## SECTION 25.

## West Coast Oil Co.

Wolfskill Well No. 59, shut off. T 1-116.

The production of this well as reported by the company and witnessed by this department, showed that a small amount of water and oil was entering the well. It was stated in this decision that it would be satisfactory to the department for the company to continue producing or redrill the well to original depth.

## PUENTE FIELD.

T. 2 S., R. 10 W., S.B.B. & M.

## SECTION UNSURVEYED.

## Petroleum Development Company.

Well No. 1, shut off. T 1-140.

Shut-off approved.

T. 2 S., R. 9 W., S.B.B. & M.

## SECTION 9.

## A. T. Currier.

Well No. 1, continue drilling. P 1-159.

The proposal to conduct certain tests following the plugging of the lower portion of the well and cementing of the 6 $\frac{1}{4}$ " casing was approved.

Well No. 1, shut off. T 1-85.

The results of the test showed that water was not completely shut off. The owner of the well stated that he would file a proposal to plug and abandon the well.

Well No. 1, abandon. P 1-185.

The proposed plan to abandon was approved as submitted.

Well No. 1, shut off. T 1-168.

In view of the results obtained from a 10-day pumping test, the department did not require that certain plugging be done which had formerly been proposed by the owner of the well.

T. 2 S., R. 11 W., S.B.B. & M.

## SECTION 11.

## Shell Company of California.

Well No. 1, drill. P 1-262.

The company stated they proposed to drill in new territory and were unable to state definitely, at that time, at what depth they would encounter productive oil measures. It was planned to cement each string of casing and keep the department informed as work proceeded. This plan of drilling was approved.

## OLINDA FIELD.

T. 3 S., R. 9 W., S.B.B. &amp; M.

## SECTION 7.

Union Oil Co.

Naranjal Well No. 8, shut-off depth. P 1-89.

Approval was given proposal contained in supplementary notice from company to shut off water at a depth of about 3100'.

Naranjal Well No. 8, supplementary to drill. P 1-307.

When a depth of 3248' was reached in drilling, the company filed a notice proposing to drill to first oil-bearing formations and shut off water above same. This proposal was approved.

Naranjal Well No. 8, supplementary to drill. P 1-347.

Approval was given proposal to cement 8 $\frac{1}{4}$ " casing above sand encountered at a depth of 3313'. The department assumed that this sand carried oil.

Naranjal Well No. 8, shut off. T 1-253.

The test showed that 10' of oil and 218' of water entered the well in 27 $\frac{1}{2}$  hours. A representative of the company expressed an opinion that the water was return drilling water. Approved proposal to make further bailing tests.

Naranjal Well No. 9, commence drilling. P 1-201.

The company estimated that productive oil sand should be encountered at a depth of about 2600' and proposed to shut off water at a depth of about 2500'. The department recommended shut-off at about 3000'.

Stearns Well No. 40, redrill. P 1-265.

The company proposed to redrill and shut off water on account of a collapsed water string. Additional information was requested relative to the new shut-off depth, as certain oil-bearing formations had been formerly shut off.

Stearns Well No. 55, commence drilling. P 1-302.

Further information was requested from the company relative to the proposed depth of water shut-off.

Stearns Well No. 55, drill. P 1-314.

Information requested in P 1-302 was furnished, giving additional data on adjoining wells. It was recommended that the company shut off water above the first oil-bearing formation encountered below a depth of 3000'.

## SECTION 8.

Petroleum Development Co.

Well No. 10, deepen. P 1-303.

The company proposed to deepen the well from 664' to about 1480', stating that, if water was encountered between these depths, a supplementary notice would be filed outlining work necessary to protect the oil-bearing formation. Subsequent reports from the company show that the production of the well was increased from 3 bbls. of oil to about 80 bbls. of oil per day, as a result of deepening.

Well No. 41, alter casing. P 1-294.

Approved proposal to remove certain casing and shut off water by cementing 6 $\frac{1}{4}$ " casing about 20' below the shoe of the former water string.

Well No. 74, shut off. T 1-40.

The results of former test of water shut-off did not conclusively show that water was shut off. A production test witnessed after completion of the well showed that the well was making about one-third water. It was recommended that the company make a 24-hour gauge of the production of certain adjoining wells and determine the amount of oil and water produced by them with the idea of finding out whether or not the well drilled deeper stratigraphically produced more water than those of less depth.

Well No. 76, plug bottom. P 1-103.

Approved proposal to rip lower portion of oil string and plug with cement.

Well No. 79, shut off. P 1-105.

Approved depth at which company proposed to shut off water.

## Petroleum Development Co.—Continued.

Well No. 79, shut off. T 1-60.

Shut-off approved.

Well No. 80, shut off. T 1-23.

Test of water shut-off approved.

Well No. 80, alter casing. P 1-220.

Approved proposal to remove as much as possible of the 6½" and 8½" casings.

Well No. 81, drill. P 1-39.

Approved proposal to shut off water at depth given in notice of intention to commence drilling.

Well No. 81, shut off. T 1-34.

Test of water shut-off satisfactory.

Well No. 82, drill. P 1-138.

The company proposed to shut off water by landing 12½" casing at a point somewhere between 800' and 1200'. It was recommended that the company shut off water at a depth of about 1050'.

Well No. 82, shut off. T 1-113.

Shut-off approved.

Well No. 83, commence drilling. P 1-232.

The company proposed to shut off water by landing 12½" casing in shale somewhere between depths of 800' to 1200'. The department recommended that the company shut off water above the first productive formation, estimated at a depth of about 1000'.

Well No. 83, shut off. T 1-209.

Tests witnessed showed that water was not shut off. Verbal proposal from the superintendent to recement was approved.

Well No. 83, shut off. T 1-219.

The results of the test showed that water was not shut off. The company agreed to file a supplementary notice covering further work at the well.

Well No. 83, supplementary to drill. P 1-339.

Approved proposal to recement and, if unable to shut off the water, to perforate the 12½" casing and force cement through the perforations.

Well No. 84, commence drilling. P 1-296.

Approved depth at which the company proposed to shut off water.

Well No. 84, shut off. T 1-228.

Shut-off approved.

Well No. 85, commence drilling. P 1-326.

Shut-off depth approved.

## West Coast Oil Company.

Well No. 63, shut off. T 1-120.

Shut-off satisfactory.

Well No. 68, supplementary to drill. P 1-301.

Approval was given supplementary proposal to shut off water at a depth of about 2200'. The log showed that oil was found in conglomerate encountered at a depth of 2300'.

Well No. 68, shut off. T 1-218.

Shut-off approved.

Well No. 69, commence drilling. P 1-369.

The estimated depth at which company proposed to shut off water was approved.

Well No. 74, shut off. T 1-155.

The results of several tests made, indicated that water was shut off. Approval to continue drilling was given. It was recommended that the company gauge the production of the well 30 days after completion and furnish the department with statement of results of the gauge.

## Olinda Land Co.

Well No. 2, deepen. P 1-2.

The proposal to deepen was approved. Information was furnished the company relative to a neighboring well, in which "bottom" water was probably encountered.

**Olinda Land Co. - Continued.**

Well No. 17, shut off. T 1-134.

The results of a production test showed that the well was making a small amount of water. The water condition of the well was not considered serious by the department. Recommendations were made to continue pumping.

**Columbia Oil Producing Co.**

Well No. 30, commence drilling. P 1-111.

The notice of intention to commence drilling stated that no water was expected in the drilling of this well. Recommendations were made by the department to protect all oil-bearing formations, from which neighboring wells were producing.

**Union Oil Co.**

Naranjal Well No. 6, shut off. T 1-18.

The results of measurement of depth to which well was open, as witnessed by the department, with metallic tape furnished by the company, indicated that hole was not open below the shoe of the water string. Approval of the shut-off was given, following measurements with a steel tape, which showed that the hole was open below the water string.

Naranjal Well No. 7, supplementary to drill. P 1-81.

It was recommended that the company shut off water about 600' below the depth proposed.

Naranjal Well No. 7, supplementary to drill. P 1-203.

Approved proposal to shut off water at the depth given in the supplementary notice.

Naranjal Well No. 7, supplementary to drill. P 1-291.

The company advised that a small amount of water entered the well after cementing the 64" casing. Recommended that the company prepare the well for test of water shut off.

Naranjal Well No. 7, shut off. T 1-186.

This test was witnessed to determine depth to top of fluid, character of fluid and depth to which hole was open.

Naranjal Well No. 7, shut off. T 1-192.

The well was pumped several days and, when rods and tubing were removed, the fluid was found at a depth of 1951'. No oil was noted in the production of the well or carried by formation removed by the bailer from bottom.

Naranjal Well No. 7, deepen, supplementary notice. P 1-309.

Approval was given supplementary proposal to rip lower portion of water string and plug same with cement up to point at which it could be removed and drill to first showing of oil and shut off water.

Naranjal Well No. 10, supplementary to drill. P 1-82.

Recommended that company shut off water at a depth of about 2450'. This decision supplemented a former decision in which it was recommended that company shut off at about 2050'. The company originally proposed to shut off at about 2400'.

Naranjal Well No. 10, redrill. P 1-144.

Approval of proposal to move rig and drill a new hole was given on account of mechanical trouble in first hole. Oil- or gas-bearing formations had not been encountered. No plugging was required.

Naranjal Well No. 10, supplementary to redrill. P 1-286.

Approved proposal to shut off water at the depth given in the supplementary notice.

Naranjal Well No. 11, commence drilling. P 1-77.

Recommended that the company shut off water about 350' higher than proposed in the notice to commence drilling.

Naranjal Well No. 12, commence drilling. P 1-78.

Recommended that the company shut off water about 50' lower than proposed.

## SECTION 16.

## Olinda Land Co.

Well No. 18, abandon. P 1-118.

Recommended that company shoot and plug well with cement between specified depths. Approved proposal to remove certain casing from the well.

Well No. 18, supplementary to abandon. P 1-167.

Approved proposal to remove as much of the 12 $\frac{1}{2}$ " casing as possible.

Well No. 21, drill. P 1-315.

The following statement was made in this decision: "There is not sufficient information at hand to indicate the depth at which water should be shut off, or the depth at which oil-bearing formations should be encountered." Recommendation was made that the company shut off water above any oil-bearing formations encountered which were producing in wells in the vicinity.

## SECTION 17.

## Olinda Land Co.

Well No. 19, commence drilling. P 1-154.

The notice from the company stated that oil-bearing formations should be encountered at about 3000' and proposed to shut off water at about 2900'. Study of peg model showing all wells in vicinity of this well indicated that water should be shut off at a depth of about 2850'. Recommendation was made that the company keep the department informed concerning character of formations encountered below a certain depth in order that a further study may be made relative to the proper depth at which water should be shut off.

Well No. 20, commence drilling. P 1-245.

The notice from the company stated that productive oil-bearing formations were expected at a depth of about 2000' and proposed to shut off water at a depth of about 1500'. Attention of the company was called to the fact that the proposed shut-off point was about 900' higher, stratigraphically, than proposed shut-off point in Well No. 10 on the same property.

## Union Oil Co.

G. & L. Well No. 49, commence drilling. P 1-75.

Recommended that company shut off water about 300' lower than depth proposed, in order to shut off below a water sand which was located above the oil sand in an adjoining well.

G. & L. Well No. 51, commence drilling. P 1-76.

Recommended that company shut off water about 275' below depth proposed, for reason given in decision No. P 1-75, above.

G. & L. Well No. 52, commence drilling. P 1-337.

Recommended that company shut off above first oil-bearing formation encountered below a specified depth.

## BREA CANYON FIELD.

T. 3 S., R. 10 W., S.B.B. & M.

## SECTION 2.

## Birch Oil Co.

Well No. 11, abandon. P 1-266.

Approved proposed method of abandoning.

Well No. 11, shut off. T 1-177.

The company found that they were unable to plug the lower portion of the well as planned. In view of the demonstration made by the company that certain casing prevented water from entering the well, this department approved a revised proposal which outlined plugging below and up into the 20" casing.

Well No. 11, test cement plug. T 1-235.

This test was witnessed to locate the top and note the setting of cement plug referred to in revised proposal mentioned in T 1-177. The test proved satisfactory.

Well No. 12, redrill. P 1-59.

On September 20, 1917, this department recommended that the company shoot and plug with cement between depths of 4276' and 4238'; also between 4090'

and 4045', in order to shut off probable "bottom" water before carrying out proposal to remove the upper portions of the 4½" and 6¼" casings and perforating 8¼" casing opposite oil sands formerly shut off. This well averaged about 3600 bbls. of water and 650 bbls. of oil previous to plugging lower portion as formerly recommended by the department.

Well No. 12, continue pumping. P 1-86.

On October 4, 1917, the company advised that they found that casing had collapsed so that tools would not go below a depth of 4100', and proposed to continue pumping for a period of about 90 days.

Well No. 12, continue pumping. P 1-187.

On January 12, 1918, the company advised that pumping test was delayed on account of non-delivery of string of tubing. Approved proposal to continue pumping well in order to complete the production test.

Columbia Oil Producing Co.

Well No. 7, shut off. T 1-156.

Shut-off approved.

Well No. 8, commence drilling. P 1-202.

The notice to commence drilling stated that the company did not expect to encounter water in this well, and estimated that oil-bearing formations should be encountered at a depth of about 2000'. A letter supplementing the drilling notice stated that the company planned to cement 15½" casing at about 750'. This proposal was approved.

Well No. 8, shut off. T 1-200.

Shut-off approved.

Brea Canyon Oil Co.

Well No. 28, redrill. P 1-365.

The notice to redrill did not give sufficient information relative to the condition of the well and work proposed. Approval to redrill was given after necessary data was received.

Well No. 30, redrill. P 1-16.

Approved proposal to move derrick and drill a new hole. The first hole was drilled to 500' when the 10" casing collapsed.

### MISCELLANEOUS FIELDS.

T. 3 S., R. 9 W., S.B.B. & M.

UNSURVEYED SECTION 36.

#### Richfield Field.

Standard Oil Co.

Kraemer Well No. 1, commence drilling. P 1-277.

Approved proposal, and recommended that the company shut off water above the first oil-bearing formation encountered.

T. 6 S., R. 10 W., S.B.B. & M.

SECTION 14.

#### Newport Field.

Standard Oil Co.

Irvine Well No. 1, commence drilling. P 1-308.

Approved proposal to drill and shut off water above first oil sand.

T. 4 S., R. 12 W., S.B.B. & M.

SECTION 19.

#### Dominguez Field.

Union Oil Co.

Bixby Well No. 1, abandon. P 1-284.

Approved proposal to abandon and remove as much casing as possible. In view of the operations of the Highland Development Co. to develop gas in this district, it was recommended that the company do such work as may be necessary to protect any gas-bearing formations which may have been encountered.

## T. 4 S., R. 13 W., S.B.B. &amp; M.

**Rancho San Pedro.**

## Standard Oil Co.

Dominguez Well No. 1, abandon. P 1-148.

The proposed method of abandonment was approved.

## Highland Development Co.

Dominguez Well No. 1, supplementary to continue drilling. P 1-92.

The physical condition of the well caused the 6 $\frac{1}{4}$ " casing to be landed without cementing. Approved proposal to continue drilling, with the understanding that, in case oil-bearing formations were encountered, water will be shut off above them.

Dominguez Well No. 1, plug bottom and recement. P 1-200.

Approved the proposal of the company to perform certain shooting and plugging operations in order to test out a possible gas-bearing formation.

## General Petroleum Corporation.

Carson Well No. 1, abandon. P 1-95.

Approved the proposal of the company to pull as much casing as possible and abandon. No plugging was required.

## T. 2 S., R. 14 W., S.B.B. &amp; M.

## SECTION 20.

**Inglewood Field.**

## Bartolo Oil Co.

Well No. 1, abandon. P 1-213.

Approved proposal to abandon. Certain shooting and plugging operations were recommended.

Well No. 1, test cement plug. T 1-122.

Tests as witnessed with information furnished by the company, indicated that a cement plug was placed against the walls of the well from a point 10' below the shoe of the 8 $\frac{1}{4}$ " casing up 35' into the 8 $\frac{1}{4}$ " casing, which fulfilled the requirements of the department as to plugging at that point.

Well No. 1, test cement plug. T 1-126.

Test as witnessed, with information furnished by the company, showed that the well was shot and cleaned out as recommended, but that the cement placed in the well did not remain in the position intended.

Well No. 1, supplementary to abandon. P 1-242.

Approved proposal to shoot and plug as outlined.

Well No. 1, test cement plug. T 1-132.

Test as witnessed, with information furnished by the company, showed that a cement plug was placed in the well between depths of 2725' and 2750', as recommended.

Well No. 1, test cement plug. T 1-139.

Test as witnessed, with information furnished by the company, indicated that a cement plug was placed in the well between depths of 2040' and 2060', as recommended. This work completed the required plugging of the well.

## T. 1 S., R. 12 W., S.B.B. &amp; M.

## SECTION 19.

## Jordan Crude Oil Co.

Well No. 1, commence drilling. P 1-83.

Approved proposal to drill, and recommended that the company cement each string of casing, except the oil string.

Well No. 1, shut off. T 1-164.

Test of water shut-off unsatisfactory. Approved proposal to recement

T. 1 S., R. 13 W., S.B.B. & M.  
SECTION 25.

## Amalgamated Oil Co.

Huntington Well No. 1, drill. P 1-15.

Approved proposal relative to depth at which 12½" and 10" casings should be cemented.

Huntington Well No. 1, shut off. T 1-42.

Shut-off approved.

## T. 3 N., R. 15 W., S.B.B. &amp; M.

## SECTION 6.

## NEWHALL FIELD.

## Tunnel Petroleum Co.

Well No. 2, commence drilling. P 1-119.

Recommended that the company drill the well in the manner proposed, furnishing this department further information in case it became necessary to cement a second water string.

Well No. 2, supplementary to drill. P 1-140.

Approved proposal of the company to shut off water at a shallower depth than originally proposed in order that an oil sand near the surface could be tested for productiveness.

Well No. 2, shut off. T 1-70.

Water not shut off. A large amount of water had entered the well while standing for test. Source undetermined. Recommended bridging the bottom of the well and conducting further tests to determine, if possible, the source of the water.

Well No. 2, supplementary to drill. P 1-165.

Approved proposal of the company to clean out the well and make a pumping test. It was noted that oil-bearing formations, being tested for productiveness in this well, were not reported in the original log of well No. 1, adjoining, and were cased off without being tested in Well No. 1.

Well No. 2, supplementary to deepen. P 1-1000.

After exhaustive tests of the top oil zone, which tests proved that the zone was not commercially productive, approval was given to deepen the well and test out the oil zone from which well No. 1 was producing.

Well No. 2, shut off. T 1-1003.

Water shut off with 10" casing. Test approved.

## SECTION 7.

## Standard Oil Co.

Well No. 22, Elsmere, commence drilling, P 1-17.

Approved proposed depth of water shut off.

Well No. 22, Elsmere, shut off. T 1-16.

Test showed water shut off and was approved as satisfactory.

Well No. 22, Elsmere, alter casing. P 1-116.

Method of redrilling to exclude, if possible, water which was being produced with the oil was approved.

Well No. 22, Elsmere, shut off. T 1-77.

Results of this test, together with tests conducted by the company and not witnessed by a representative from this department, indicate that several attempts to plug the bottom of the well after cementing the 8½" casing, failed to shut the water off or demonstrate its source. Recommended further bailing tests and requested notice of proposed new work.

Well No. 22, Elsmere, abandon. P 1-184.

Recommended certain work in plugging and abandoning the well.

## SECTION 18.

## Buick Oil Co.

Well No. 1, commence drilling. P 1-209.

Depth of water shut could not be determined in advance. Recommended that water be shut off, however, above any oil-bearing formations encountered in order that the productiveness of the formations might be determined.

Well No. 1, shut off. T 1-1000.

Water not shut off. Approved proposal to drive the casing in an attempt to exclude all water.

Well No. 1, redrill. P 1-1001.

Method of redrilling to sidetrack lost shoe joint to effect water shut-off was approved.

Well No. 1, shut off. T 1-1002.

Water shut off. Test approved as satisfactory.

Well No. 1, redrill. P 1-1005.

Approved proposal to redrill and shut off water at a lower depth in order to test out oil-bearing formations encountered below the proposed depth of shut-off.

T. 3 N., R. 16 W., S.B.B. & M.

## SECTION 12.

## E. A. &amp; D. L. Clampitt.

Well No. 11, commence drilling. P 1-35.

Approved depth of water shut-off as proposed.

Well No. 12, commence drilling. P 1-149.

Proposed depth of shut-off was approved, providing oil formations were not encountered above the proposed depth.

## SECTION 13.

## E. A. Clampitt.

Well No. 3, abandon. P 1-37.

Recommended that the well be shot and plugged with cement in certain shale bodies during abandonment.

## SECTION 16.

## Standard Oil Co.

Well No. 6, Wiley, alter casing. P 1-226.

Approved proposal of the company to remove certain casing.

Well No. 14, Wiley, alter casing. P 1-227.

The proposal of the company to alter casing was approved.

Well No. 14, Wiley, alter casing. P. 1-228.

Approved company's proposal to remove portion of the casing with certain modifications.

Well No. 16, Wiley, alter casing. P 1-229.

The proposal to remove certain casing as outlined was approved.

Well No. 18, Wiley, alter casing. P 1-230.

Approved proposal to remove a portion of the casing.

Well No. 18, Wiley, redrill. P 1-1003.

Approved method of redrilling outlined by the company.

Well No. 18, Wiley, supplementary redrill. P 1-1006.

Due to changed conditions the supplementary proposal to redrill was approved.

Well No. 26, Wiley, alter casing. P 1-223.

The company's proposal to pull certain casing was satisfactory.

Well No. 27, Wiley, alter casing. P 1-221.

Approved proposal to remove portions of the casing providing the water string were not disturbed.

Well No. 29, Wiley, commence drilling. P 1-4.

Recommended depths at which water should be shut off in this well.

## Standard Oil Co.—Continued.

Well No. 29, Wiley, shut off. P 1-8.

All water not excluded by landing casing. Recommended attempt be made to drive casing further and exclude all water.

Well No. 29, Wiley, supplementary to drill. P 1-14.

Being unable to drive casing further the company proposed to proceed with drilling. This proposal was approved.

Well No. 30, Wiley, commence drilling. P 1-43.

Approved proposed depth of water shut-off.

Well No. 30, Wiley, shut off. T 1-30.

Water not shut off. Recommended further work in attempt to exclude water.

Well No. 30, Wiley, shut off. T 1-35.

After driving the casing further water was shut off. Test satisfactory.

Well No. 30, Wiley, shut off. T 1-43.

Water was encountered below former shut-off, and cased off with second water string. Test approved as satisfactory.

Well No. 30, Wiley, alter casing. P 1-132.

Approved company's proposal to remove a portion of the casing from the well.

T. 3 N., R. 17 W., S.B.B. & M.

## SECTION 2.

## Standard Oil Co.

Well No. 21, P. C. O., plug. P 1-1002.

Recommended certain plugging to determine the source of water.

Well No. 21, P. C. O., abandon. P 1-1007.

Approved proposed method of abandonment.

Well No. 13, Cal. Star, alter casing. P 1-204.

The proposal to remove certain casing from the well was satisfactory.

Well No. 24, Cal. Star, alter casing. P 1-205.

Approved proposal to remove a portion of the casing from the well.

T. 4 N., R. 15 W., S.B.B. & M.

## SECTION 31.

## June Oil Co.

Well No. 1, commence drilling. P 1-1004.

Proposed depth of water shut-off was approved, providing oil formations were not encountered at a shallower depth, in which case a recommendation was made to bridge the well and shut off water above such formations.

T. 5 N., R. 16 W., S.B.B. & M.

## SECTION 20.

## Wheat and Defreest.

Well No. 1, commence drilling. P 1-157.

No estimate given by the company as to depth at which water should be encountered. Recommended close watch of formations penetrated and required a water shut-off above oil-bearing formations if encountered, in order that such formations might be properly tested.

## CHAPTER IV.

### VENTURA COUNTY.

By IRVING V. AUGUR, Deputy Supervisor.

This district was formerly under the supervision of M. J. Kirwan, Deputy Supervisor of District No. 1, with offices in Los Angeles. The writer took charge of it in December, 1917.

It was found, upon taking charge, that the greatest need of the district, outside of routine tests and reports of well operations, was a more thorough understanding of underground conditions and structure in the various fields. It should be borne in mind that, unlike other districts in the state, the productive areas in Ventura County are scattered from one end of the county to the other, and that each producing area, of which there are approximately thirty-five, presents entirely different underground conditions, due to the individual structures upon which they are located.

For this reason it became necessary to study each individual area separately, and the best preliminary method to such study was apparently through the construction of peg models. Consequently attention was first paid to the larger producing areas, and the following peg models erected:

- (1) South Mountain field.
- (2) Bardsdale field—Bardsdale dome.
- (3) Simi field.
- (4) Ventura field.

In addition, the following are partly completed:

- (1) Bardsdale field—Montebello dome.
- (2) Pico Cañon field.

Since the construction of these models, many instances have occurred which have proved their value in anticipating the depths at which oil and water-bearing formations should be encountered and the proper depth of shut-off. Similar results have been obtained from the use of underground contour maps, but it has been found that the peg model is more easily and quickly understood by the majority of operators in the field, and, if properly constructed, is as accurate as the contour map. In one instance the peg model proved more useful and accurate than cross-sections made by an engineer of one of the companies. In this case, the trouble lay in the proper correlation of certain cross-sections and the improper correlation in other sections, due to the impossibility of forming a mental picture of the substructure of the entire producing area.

Many companies operating on small production might increase the amount of production materially upon thorough analysis and knowledge of the structural conditions.

Logs of approximately 300 wells have been filed during the past year. The number of logs now on file for the district is more than double the number on file for the previous year. Out of the total number of logs listed for the county, only 65 per cent have so far been filed. This number, however, includes logs of a great many wells drilled and abandoned years ago. The logs of most of these old wells have been lost or destroyed. Graphic logs drawn number 311.

The total production of the county for the fiscal year ending July 1, 1918, amounted to 1,646,839 gross barrels of which 1,126,183 barrels was oil and 520,656 barrels was water. The proportion of water, therefore, for the county was 32 per cent. According to monthly production reports filed in this office, the amount of oil produced during the fiscal year exceeded the amount of oil produced during the preceding year by about 230,000 barrels. There was also an increase in the water produced, amounting to approximately 265,000 barrels. The proportion of water produced with the oil for the county has risen from 27 per cent in 1916-1917 to 32 per cent in 1917-1918. The production per producing well per day, during the year, was 9.3 barrels of oil and 5 barrels of water, as against 7.9 barrels of oil and 3.1 barrels of water for the year previous.

#### **Case of People of the State of California vs. Thomas A. Slocum.**

During the year it became necessary to file complaint against Thomas A. Slocum, due to the failure of Slocum & Company to file logs of wells drilled on its property on Sec. 21, T. 4 N., R. 21 W., S. B. B. & M., Santa Paula Oil field, and for failure to file monthly production reports, notices of intention to drill new wells, notices of intention to abandon, redrill or deepen old wells, and for failure to notify the department for test of water shut-off before finishing and completing new wells. After repeated efforts, in writing, on the part of the state deputies to obtain the necessary information, and the entire disregard by the company of these requests, the above mentioned complaint was filed by the District Attorney of Ventura County. The defendant entered a demurrer, which was not sustained.

In the meantime, all of the desired records were prepared by the Company and submitted to this office. This department thereupon requested that the case be dismissed. This action is in line with a similar action brought against the Providential Oil Company, in District No. 1, and reported on pages 127 and 128 of the Second Annual Report (Bulletin No. 82).

**Early History of Operations in Ventura County.**

According to a report by Professor Silliman published in 1865, the presence of "fluid inflammable substance" was known in California as early as 1792. For many years the presence of petroleum on the surface was regarded as a detriment to the property because of the loss of live stock, which became mired in the pools of petroleum. Various reports indicate that the Indians in the region for many years used the petroleum occurring in the numerous seepages, in the same way as the Indians made use of the petroleum in the Pennsylvania oil fields previous to the development of oil. As early as 1854 there are records of the development of petroleum by Mexicans in this region. It is said that the Mexicans erected a still, with a copper worm, from which illuminating oil was made. In the year 1861, George S. Gilbert, a San Francisco man, erected a refinery for handling oil on a small scale. The refinery was built at what was afterwards known as Camp No. 1 of the California Development Company. The supply of oil came from natural wells or seepages, from which he is reported as having obtained 400 barrels of oil, without apparently diminishing the supply. The principal product of the refinery was illuminating oil. Gilbert's venture was considered a success until his plant was destroyed by fire. It was rebuilt, but a second time burned to the ground. The work was then taken up by the Philadelphia Oil Company, the Hayward Company, California Development Company, T. R. Brad, Stanford & Company, and others. In all, six camps were established by the California Development Company, located as follows:

Camp No. 1 was situated on the property of the Arnaz family, later known as the Ferguson place, in the southwest corner of the Rancho Ojai, on the old Ojai Creek Road. It was at this camp that oil operations were first started by Thomas R. Bard, upon his arrival from Pennsylvania. A house was built here for Mr. Bard, which in recent years has gone to ruin.

Camp No. 2 was situated close to the site now occupied by Camp Comfort, being about a mile south of the town of Ojai on the San Antonio Creek. Here one well was drilled on the property of P. T. Hobson.

Camp No. 3 was situated in the upper Ojai Valley.

Camp No. 4 was established on the Rancho Ojai in Pinkerton Cañon.

Camp No. 5 was situated near the head of Saisar (See-saw) Creek.

Camp No. 6 was near Camp No. 5. A number of wells which were drilled in this camp, and known as the "Astarta" wells, are now operated by the Pyramid Oil Company.

In a published report, made by S. F. Peckham in June, 1866, is found the statement that, during the course of ten months, 3000 bbl. of oil

had been shipped from the Ventura oil fields. The greater part of this production came from tunnels and seepages, and the operators were conservatively advised to follow this line of development, although there were a few wells producing small amounts of oil at this time.

In 1877, the Standard Oil Company was operating on the Santa Ana Rancho, in the Cañada de Los Coches, and also in Santa Paula Creek, north of Santa Paula. In the same year, Adams, Thayer and Edwards were operating five tunnels, ten wells, and several springs in Adams Cañon; and Saxby, Davis and Remington were drilling near the eastern end of Sulphur Mountain.

Acknowledgments are made to Messrs. Gidney, Brooks and Sheridan's "History of Santa Barbara, San Luis Obispo, and Ventura Counties," and to Professor Silliman's "History of Recently Discovered Regions in California," for information on this subject.

With the advent of the Hardison & Stewart Oil Company, in 1883, operations in this district received a decided impetus. The principal developments were carried on in the Rancho Ex Mission, Sespe Creek, and later in Torrey Cañon.

The combination of Hardison, Stewart and Bard interests, by which the Union Oil Company was formed, developed further interest in active drilling operations, and placed the county first in point of production in the state in the early days. The Hardison and Stewart interests which entered the Union Oil Company were the Hardison & Stewart Oil Company and the Sespe Oil Company; the Bard interests being represented by the Torrey Cañon Oil Company. The organization of the Union Oil Company took place in 1890.

Subsequent to these early developments, the attention of oil men was diverted from the Ventura oil fields; but in recent years the attention of the oil prospector has reverted to this county. During the past two years a number of discoveries have added materially to the importance of this county in respect to production of oil. Among the new discoveries may be mentioned the South Mountain field, with a daily production of 600 bbl., and the Ventura field, with a daily production of approximately 200 bbl. of oil. The latter field includes two producing areas, the first being Ventura field proper, in which the Shell Company of California, the General Petroleum Corporation and State Consolidated Oil Company are represented, and the other area being about five miles south of Ojai, in which the New Mexico Oil Company and H. L. Hayes are operating.

As contrasted with the early developments, recent developments have been undertaken upon later ideas of geologic structure. The result has been a considerable increase in the amount of production from the county. A number of major structural features, beneath which lie

formations which are oil-bearing in other parts of the county, still remain unprospected in this field. Quite recently these have been attracting considerable interest among oil operators, and it is probable that the production for the county will be increased.

For the sake of convenience, this district has been divided, and will be considered under the following named fields: Piru, Simi, Bardsdale, Sespe, South Mountain, Santa Paula, Ojai, Ventura and Miscellaneous.

Following is a table showing the number of wells listed, logs filed, graphic logs made, producing wells, average daily production of oil and water, and percentage of water, shown by fields.

TABLE I. Field Operations, Ventura County.

Field	Wells listed	Logs filed	Graphic logs	Number wells accounted for by production reports	Number wells actually producing according to production reports	Total daily production		Average daily, per producing well		Per cent water
						Barrels oil	Barrels water	Barrels oil	Barrels water	
Piru	160	57	15	82	82	378.5	629.8	4.6	7.7	62.5
Simi	47	34	32	31	31	262.0	26.8	6.5	0.9	12.1
Bardsdale	173	164	155	129	129	1,597.6	125.5	12.4	0.9	7.2
Sespe	135	72	25	48	32	112.6	19.7	3.5	6.6	5.4
Santa Paula	166	122	32	39	35	94.8	44.8	2.7	1.3	33.4
South Mountain	31	13	11	10	9	501.0	.3	65.7	.03	.05
Ojai	129	88	25	44	33	210.4	408.1	6.4	12.4	69.0
Ventura	24	17	14	9	9	161.8	327.6	18.0	58.6	76.7
Miscellaneous	3	3	2							
Totals	858	550	311	392	360	3,348.7	1,782.6	9.3	5.0	34.7

TABLE II. Summary of Notices Received and Reports Issued.

Field	New wells		Test of water shut-off		Deepen or redrill		Abandon		Supplementary	
	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
Piru	1	2	2	2	1	1	10	10	1	4
Simi	15	11	17	14	5	4	1	1	11	16
Bardsdale	3	3	28	20	7	6	6	7	12	13
Sespe	1	1	6	5	1	2	2	2	2	3
South Mountain	12	9	17	18	11	11	1	1	4	3
Santa Paula	2	2	5	3	1	1				
Ojai	3	3	4	4	2	2	2	2	3	3
Ventura	9	9	6	5	7	7	1	1	16	13
Miscellaneous	3	3	1		1					
Totals	49	43	86	71	36	34	23	24	49	49

### PIRU FIELD.

This field includes developed and undeveloped territory lying north and south of the Santa Clara River, adjacent to the town of Piru. Records show seven producing companies in this field during the past year: three companies being located north, and four south, of the Santa Clara River.

With one exception, each operating company in this field obtains its production from separate and distinct anticlinal folds, and the underground conditions governing the accumulation of oil and water are, therefore, distinct and noncommunicating. A feature of remarkable interest, from the standpoint of geology and the influence of underground structure upon accumulation, is evident upon the property being developed by the Diamond Valley Oil Company. Upon this property a plunging anticline from a westerly direction develops into a marked overturn transverse to the axis of the anticline. It is possible that wells drilled in this area have penetrated one stratum from two to three times.

#### Water Conditions.

As outlined in the Second Annual Report, Bulletin No. 82, the water conditions in several producing areas in this field are serious. One company is producing 16 bbl. of oil and 211 bbl. of water per day, or 93 per cent water. It is possible, judging from surface evidence, that a large proportion of the water produced is surface water. An attempt should be made to locate the source of the water. Reference to Table I shows that there are 82 producing wells in this field, with an average daily production of 4.6 bbl. oil and 7.7 bbl. water per well, or 62.5 per cent water for the field. A comparison with the production figures given for last year shows a decrease, for this year, in production of oil of about one barrel per day per producing well and an increase of about one barrel of water per day. The total oil produced by the field for the fiscal year was 130,103 bbl. and the total water 189,959 barrels.

#### Recent Developments.

As shown by Table III, ten wells were abandoned during the fiscal year, and only one new well drilled. All wells abandoned were some distance from any productive area. This shows that the attempt to increase the productive area in this field has met with failure.

One well, during the process of abandonment, developed a considerable increase in oil, after ripping and endeavoring to remove the oil string, showing that oil had been encountered in an upper horizon and

ceased off during the preceding production period. This well now produces four times as much oil as formerly.

TABLE III. Piru Field.

Section, township, range.....	Company	New wells		Test of shut-off		Deepen, redrill, etc.		Abandon		Supplementary	
		Notices.....	Decisions.....	Notices.....	Decisions.....	Notices.....	Decisions.....	Notices.....	Decisions.....	Notices.....	Decisions.....
8-4 N.-18 W.	Diamond Valley .....			1	1					1	1
32-4 N.-18 W.	Cameron Oil, Midway Supplementary.....							3	3		3
33-4 N.-18 W.	C. Victor Stephens.....							3	3		
34-4 N.-18 W.	C. Victor Stephens.....							3	3		
36-4 N.-18 W.	Beatty Oil and Development Company.....	1	2	1	1	1	1				
1-3 N.-18 W.	Beatty Oil and Development Company.....							1	1		
	Totals .....	1	2	2	2	1	1	10	10	1	4

## SIMI FIELD.

## Recent Developments.

The Simi field has been the scene of greater activity in drilling operations than any other field in Ventura County during the past year. Fifteen new wells were started during the year, and only one well was abandoned. During the abandonment of this well a considerable volume of gas was developed, and the well is now producing gas for use on the lease.

Of these new wells, thirteen were started by the Doheny-Pacific Petroleum Company, and two by the Santa Susana Oil Corporation. The drilling of these wells has practically defined the limits of production on the east and west ends of the field. The Simi anticline, from which the wells obtain their production, at this point is plunging at an angle of approximately  $10^{\circ}$  in a westerly direction. The south flank is nonproductive, due to an overturn or faulting of this side of the axis.

The two new wells of the Santa Susana Oil Corporation which were drilled in the eastern limits of the field failed to locate the shallower oil horizon, which is the most productive horizon in this field. The same condition is true of two new wells drilled by the Doheny-Pacific Petroleum Company on the western edge of the pool. Here, also, the portion of the oil horizon at the crest of the anticline is nonproductive.

Two wells are now drilling several miles to the west of the main field on what is called the Searab Lease. The production obtained in this vicinity is derived from beds of the Sespe formation.

Through the courtesy of the Doheny-Pacific Petroleum Company a copy of an accurate map of this field was furnished this department. From the data, as shown on the map, a peg model to a scale of 100'

to 1" was prepared by this department. This model pictures accurately the underground structure of the field, showing the zones of oil and water, and the distance of each zone from the surface.

The best indicator for a correlation was found to be the base of a sandstone series, called the Sespe formation. The Sespe formation is underlain by shales of Tejon Age, and it is from the Tejon formation that the production of oil is obtained. The top of the first productive oil horizon is approximately 200' below the base of the Sespe sandstone, and the two formations in this region are apparently conformable.

The most important feature connected with the occurrence of petroleum in this area is the fact that the oil sands are lenticular. The oil sands do not appear in outcrop in the exposed oil series, as they rise to the surface farther east. Sands carrying heavy oil have been encountered near the base of the oil series. These sands, however, do not appear in outcrop.

#### Production and Water Conditions.

The total production of the field for the year amounted to 73,552 bbl. oil and 9788 bbl. water, or 12.1 per cent water. The highest proportion of water reported by any one company is 22 per cent. The average daily production per producing well amounts to 6.5 bbl. oil and .9 bbl. water. The average gravity of the oil is 33° Baumé.

On the basis of oil production per well, the Simi field ranks fourth in the county, being surpassed by the South Mountain, Bardsdale and Ventura fields, respectively.

Following is a table showing the notices received and reports issued for the field, and a list of the reports showing briefly the character of the work undertaken:

TABLE IV.  
Simi Field.

Section, township, range.	Company	New wells		Test of shut-off		Deepen, redrill, etc.		Abandon		Supple- mentary	
		Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
32-3 N.-18 W.	Doh ny-Pacific Petroleum	1	1	3	2	1				1	1
34-3 N.-18 W.	Doheny-Pacific Petroleum	1									
35-3 N.-18 W.	Doheny-Pacific Petroleum	8	7	10	8	3	3	1	1	8	7
36-3 N.-18 W.	Doheny-Pacific Petroleum	3	1	1	1					1	1
26-3 N.-18 W.	Santa Susana Oil Corporation	2	2	3	3	1	1			1	1
	Totals	15	11	17	14	5	4	1	1	11	10

**BARDSDALE FIELD.**

The Bardsdale field includes two distinct anticlines and productive areas. In the eastern edge of the field, the Montebello anticline is being developed by the Montebello Oil Company, Calumet Oil Company, and Home Ranch Petroleum Company. The Bardsdale Dome, on the western edge of the field, is being developed by the Union Oil Company, Bardsdale Crude Oil Company and Bell Oil Company.

The daily production from the Montebello Dome amounts to 1514 bbl. of oil and 119.4 bbl. of water, or 7.3 per cent water. The daily production of the Bardsdale Dome amounts to 83.6 bbls. oil and 6.1 bbls. water, or 6.8 per cent water.

The production of the field as a whole, during the year, amounted to 579,136 bbl. oil and 45,188 bbl. water, or an average of 7.2 per cent water. A comparison with production figures in the Second Annual Report shows a decrease in amount of oil produced of approximately 1 bbl. per producing well per day, and an increase of .4 bbl. water per well during the same period. The decrease in the amount of oil produced is probably accounted for by the decrease in drilling operations. Three new wells have been drilled during the fiscal year, as compared with nine new wells the year before.

**New Developments.**

Reference to Table V shows that the three new wells in this field were drilled by the Calumet Oil Company, Montebello Oil Company and the Petroleum Midway Company, Ltd. The results of drilling by the first two named companies will not materially increase the productive area of the field. Should the new well being drilled by the Petroleum Midway Company, Ltd., prove productive, the proved acreage between the Montebello and Bardsdale domes will be largely increased.

During the past year six wells have been abandoned, as compared with three wells the year previous. Five of the wells abandoned were situated on the Bardsdale Dome, and the work of abandonment is a forerunner of the further abandonment of wells in the field on a larger scale, due to the extremely low production of wells on the edge of the field.

**Construction of Peg Models.**

In order to better understand underground conditions in this field, a peg model of the Bardsdale Dome has been completed by this department, and a peg model of the Montebello Dome is in process of construction. The peg model of the Bardsdale Dome shows a simple dome structure, the apex of the dome being approximately on the line between Sections 1 and 12, T. 3 N., R. 20 W., S.B.B. & M. The direction of the axis is almost east and west.

**Extent of Productive Oil Horizons in the Bardsdale Dome.**

From data as shown by the peg models, it is evident that most of the production up to the present time in the Bardsdale Dome is derived from an oil horizon approximately 400' in thickness, and is obtained close to the apex of the fold. Wells on the edge of the field are now idle, or have been abandoned. It is noticeable that certain wells drilled in the western portion of the field have encountered and are producing from an oil horizon which overlies the main productive horizon and outcrops before reaching the apex of the fold. The oil is of a comparatively low gravity, and considerable water is produced with the oil, oil and water being frequently reported as occurring in the same sand. Several wells in this area have been deepened to the main productive horizon, increasing very materially the production and gravity of the oil.

**Extent of Oil Horizons in the Montebello Dome.**

The division of this area into three oil and two water zones has been described in the Second Annual Report, Bulletin No. 82. A third salt water zone was encountered below the third oil zone mentioned in this report. For a considerable time it has been recognized that the first oil zone in this area is not as extensive laterally as the second oil zone. The first zone is not productive east of the line between Sections 3 and 4, T. 3 N., R. 19 W., S.B.B. & M. The oil sands of this zone are encountered in the area, but have been found to contain no oil. It has been the policy of companies which have drilled through this top productive oil horizon to land a water string below both the oil horizon and the first salt water zone, and immediately above the second oil zone. This policy may be found, in the future, to be responsible for considerable water trouble in the first oil horizon, which is productive in wells to the west. It may, at some time, be necessary, on account of the prohibitive amounts of water, to change the depth of water shut-off in wells which have penetrated both the first oil and first water horizons, or to gradually abandon the shallow wells now producing from the top oil zone. The amount of water entering the top oil zone has increased 23 per cent from November, 1916, up to June, 1918. A definite policy should be adopted in drilling new wells in this area, looking towards the mudding and protection of the top oil zone in all new wells drilled.

Not only is the first oil zone nonproductive in the eastern portion of this field, but several hundred feet at the top of the second zone are nonproductive. Original plans for shutting off water in this area called for a uniform stratigraphic shut-off above the second oil zone, irrespective of the productiveness or nonproductiveness of the top portion of this zone. Recently the tendency has been to carry water from the first salt water zone into the nonproductive portion of the second oil zone.

The results of such a policy, if continued, may introduce water trouble, which may not for the time being be noticeable in adjoining wells. This policy should be discouraged unless the portion of the oil zone to be cased off has been fully protected from top water.

Another feature of interest is the discovery, on the eastern edge of the field, of the existence of probable edge water in the lower portion of the second oil zone. Several wells having encountered this probable edge water have been plugged back ostensibly as having encountered the third salt water zone. One well which encountered this probable edge water has been deepened farther into the oil zone to obtain greater production, and is now producing considerable water from the edge water sand or sands. This condition must be anticipated in future drilling in this area and steps taken to prevent the infiltration of water into the oil sands in any well to be drilled or already completed. A co-operative spirit must prevail in all operations in order that the water problem may be handled efficiently and the danger from infiltration avoided.

At the present time water conditions are not serious, but the source of possible water trouble must be recognized and future operations be guided by definite protective policies.

Following is a summary of notices received and reports rendered during the fiscal year:

TABLE V.  
Bardsdale Field.

Section, township, range	Company	New wells		Test of shut-off		Deepen, redrill, etc.		Abandon		Supplementary	
		Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
3-3 N.-19 W.	Home Ranch Petroleum Company				1	1	1				
3-3 N.-19 W.	Calumet Oil	1	1	2	2						
4-3 N.-19 W.	Montebello Oil Company	1	1	23	15	6	5			13	10
5-3 N.-19 W.	Montebello Oil Company			1				1	1		1
6-3 N.-19 W.	Montebello Oil Company							2	2	1	
5-3 N.-19 W.	Petroleum Midway, Ltd.	1	1	1							
12-3 N.-20 W.	Union Oil Company of California			1	1						
12-3 N.-20 W.	Wm. Z. McDonald				1			3	4	1	2
Totals		3	3	28	20	7	6	6	7	12	13

#### SESPE FIELD.

This field includes all the territory adjacent to the Big and Little Sespe creeks. The producing areas are located mainly in Little Sespe Creek and its tributaries.

The principal operators in the Sespe field are the Big Sespe Oil Company, Kentuck Lease, Sudden & Emslie, Mutual Oil Company, Rose

Oil Company, Union Oil Company and White Star Oil Company. Many of the wells located in the upper portion of the Little Sespe Creek were among the first producing wells in Ventura County. A great many of the wells have been abandoned on account of small production.

On October 2, 1917, a disastrous fire swept over the northern portion of the field, which destroyed many rigs, houses and tanks. Of the twenty-six rigs so destroyed, only ten have been rebuilt. Subsequent to the fire, the production was approximately 1700 bbl. per month, of which only about 1100 bbl. per month have been recovered.

#### **New Developments.**

Only one well was started during the past year. This well is on the property of the Big Sespe Oil Lease, in the group of wells which mark the northern limit of productive territory in the Big Sespe Creek. Two wells have been abandoned.

Very little development has taken place in this field during the fiscal year, and but slight, if any, progress has been made, due principally to the forest fire which laid waste such a large portion of the northern part of the field.

#### **Production and Water Conditions.**

A comparison of the present production figures and those issued last year shows the daily production of oil per producing well to be practically the same. A considerable *decline* in water is shown, however; and no area of excessive water production was reported. The total amount of oil produced by the field was 30,845 bbl., and the total amount of water 6165 bbl., the water production being 9.4 per cent of the gross production.

#### **Future Developments.**

As almost all of the productive areas, and the prospective productive areas, in this field are located some distance from shipping points, and the only road to the district is a wagon road which is practically closed to travel during the winter months, and, furthermore, since the production obtained is small, and the producing areas and folds are considerably limited, further extensive developments during the coming year are not anticipated. Future reports of this district will undoubtedly show a decline in operations undertaken and production, rather than an increase.

Following is a table showing the number of notices received and decisions rendered and a list of decisions for the field:

TABLE VI.  
Sespe Field.

Section, Township, Range	Company	New wells		Test of shut-off		Deepen, redrill, etc.		Abandon		Supplementary	
		Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
6-4 N.-19 W.	Sudden & Emslie					1	1	2	1	1	1
20-4 N.-19 W.	Oak Ridge Oil Company							1	1	1	2
1-4 N.-20 W.	Kentuck Lease			1	1						
33-5 N.-19 W.	White Star Oil			2	1						
23-5 N.-20 W.	Big Sespe Oil Lease	1	1	3	2						
	Totals	1	1	6	5	1	2	2	2	2	3

### SOUTH MOUNTAIN FIELD.

#### General Description.

The most important developments in the county during the fiscal year have taken place in the South Mountain field.

Since the completion of the first well in this field in April, 1916, twenty-one additional wells have been completed or are drilling, and the field has risen from fifth place to second place in point of production in the county. During the fiscal year the daily production from this field amounted to 591 bbl. of oil and .3 bbl. of water daily, as compared with 134 bbl. oil and .4 bbl. water for the previous year. The daily production per producing wells was 65.7 bbl. of oil, as compared with 6.5 bbl. of oil per producing well in the Bardsdale field, which has the largest total production of all other fields in the district. Such a comparison gives an idea of the production which may be expected of this field in the near future.

A large proportion of the production was obtained from wells which flowed oil while drilling. If the present rate of progress obtains for the coming year, it is not improbable that the field will produce approximately two-thirds as much oil as the Bardsdale field.

Up to this time no water-bearing formations have been discovered above the top of the first oil horizon. Drilling operations are, therefore, much simpler than under the conditions encountered in the Montebello Dome of the Bardsdale field, where salt water zones have been reported.

#### Geologic Formations and Structure.

The structure of this field is anticlinal. It is very similar to the Bardsdale Dome, of which it is a continuation to the west. The larger production is obtained at the apex of the fold, which plunges both

easterly and westerly. The dip on the north flank is considerably steeper than that on the south flank. There is a possibility that the dome is slightly overturned to the north. From surface indications it appears that the axis of the anticline, as it plunges westward, separates into two axes, which diverge and finally disappear under the floor of the Santa Clara River Valley, south of the town of Santa Paula. The southerly branch of the anticline may turn towards the southwest, parallel with the foothills on the south side of the river.

Recent drilling in the productive area in this field has been confined solely to beds of the Sespe formation. Wells which were started in these beds have been drilled to a depth of 3000' without encountering the Tejon shales, which probably underlie this area.

Beds of later age than the Sespe, which in this area include the Vaqueros, Puente and Fernando, have been eroded from the apex of the fold and swing around the plunging end of the axis several miles to the west of the dome. They are, therefore, unimportant as oil producing formations in the present producing area.

#### **New Developments.**

At the present time, in this field, there are four wells drilling, which will no doubt determine the extensiveness of the pool along the axis of the anticline in an easterly and westerly direction.

Comparing the structure of this field with the structure of the Bardsdale and Montebello domes, which are a natural extension of this anticline towards the east, it seems probable that the limits of the production of the field will be much more restricted than has been generally conceded by the operators. It is very probable, as mentioned above, that the first oil horizon is less extensive than the lower oil measures, and it is also possible that edge water will be found in various sands of the lower oil formations. The productive area will probably not exceed one and a half miles along the axis and one-half mile transverse to the axis at the apex of the dome.

In an attempt to develop formations which at one time carried oil and outcrop near the crest of the mountain, one well was drilled very close to the axis of the syncline which parallels the South Mountain Dome. It is claimed that the oil sand which showed on the surface, and which is probably of Puente Age, was encountered at a depth of about 1500', but that the sand did not carry oil at this point, and the well was therefore abandoned.

#### **Construction of Peg Models.**

In order to better study the underground structure and drilling conditions, a peg model has been constructed by this department. In this area sand and shale frequently grade one into the other in com-

paratively short distances, and the coloring of the bands, so characteristic of Sespe formation, is not continuous throughout the stratum. Therefore it is difficult to make accurate correlation.

Table VII shows the proposals received and reports issued for the fiscal year:

TABLE VII.  
South Mountain Field.

Section, township, range.	Company	New wells		Test of shut-off		Deepen, redrill, etc.		Abandon		Supplementary	
		Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
17-3 N.-20 W.	The United Oil			2	4	1	1			1	1
18-3 N.-20 W.	Santa Paula Oil Association	1									
18-3 N.-20 W.	Santa Paula Oil Company	2	2	1	1	4	4				
18-3 N.-20 W.	Oak Ridge Oil Company	3	2	6	6	4	4			1	1
13-3 N.-21 W.	Oak Ridge Oil Company	1	1	5	5	2	2			1	
14-3 N.-21 W.	Oak Ridge Oil Company	3	2								
29-3 N.-20 W.	Hondo Oil Company	1	1	1	1			1	1		
13-3 N.-21 W.	H. P. Oates	1	1								
13-3 N.-21 W.	Union Oil Company of California			2	1					1	1
Totals		12	9	17	18	11	11	1	1	4	3

### SANTA PAULA FIELD.

#### Recent Developments.

There has been less activity in this field during the past year than in any other field in the district. An extension of the field towards the west is a possibility. Similar areas further west along the Fernando-Monterey contact, and located in the Ventura field, have recently received a good deal of attention and have developed a considerable quantity of oil.

#### Production and Water Conditions.

The production for wells in this field is less than any field in this district, amounting to 2.7 bbl. oil and 1.3 bbl. water per producing well per day, or an average of 34.3 per cent water. The production of the field shows a decrease of approximately one-half barrel of oil per day, as compared with the production of the previous year, the amount of water being practically the same.

The following table gives a record of proposals received and reports issued for the fiscal year:

TABLE VIII.  
Santa Paula Field.

Section, township, range.	Company	New wells		Test of shut-off		Deepen, redrill, etc.		Abandon		Supplementary	
		Notches	Decks	Notches	Decks	Notches	Decks	Notches	Decks	Notches	Decks
18-4 N.-20 W.	Timber Canyon Syndicate.....			2	1	1	1				
20-4 N.-20 W.	Santa Clara Oil and Developm nt.....			2	1						
29-4 N.-20 W.	Mausard & Jameson.....	1	1								
22-4 N.-21 W.	American Ventura Oil.....			1	1						
25-4 N.-22 W.	Saltmarsh Canyon Oil.....	1	1								
	Totals .....	2	2	5	3	1	1				

### OJAI FIELD.

#### Recent Developments.

Since the acquisition of extensive property, formerly owned by the Bard Oil and Asphalt Company, in this field, by the Pan-American Petroleum Company, considerable new developments have been in progress during the fiscal year. Three new wells were started by this company, two of them being located in producing territory, the third seeking to open up new areas about two miles west of the main lease. The latter well, known as "Pinkerton" No. 1, is drilling close to, and south of, prolific seepages which occur at the outcrop of oil strata, which at this point cross Pinkerton Cañon and dip 65° toward the south. The completion of a commercially productive well in this locality would undoubtedly prove up a large portion of territory in the western and southern part of the field.

Great importance is attached to the completion of a well drilled by the Great Republic Oil and Paint Company, near the south line of Sec. 8, T. 4 N., R. 21 W., S.B.B. & M. This well was drilled only a few hundred feet from a well on this property drilled in 1902 by the Northern Oil Company, which well was carried to a depth of 1460' and was producing six barrels of oil per day nine years later.

Both of these wells enter the Tejon formation at the surface some distance north of the fault which marks the southern limit of the Santa Paula ridge and which has been considered as defining the northern limit of producing territory. The Tejon shales at this point are dipping approximately 45° north and gradually assume an almost vertical position before reaching the fault to the south. These wells are apparently the only wells which have obtained production directly

from the Tejon formation in this field. The presence of oil in this locality where the oil bearing formations, from which the wells produce, outcrop a short distance to the south, and where no seepages occur, may be due to one of the following reasons:

1. The hardness and compactness of the Tejon oil sands and shales may prevent the escape of oil and gas where these beds outcrop a short distance south of the wells.

2. The dip of the fault plane may be a low angle, and the oil may be derived from an accumulation in the fault zone and a gradual transmission into the overlying beds of Tejon formation. Several factors may be mentioned in support of this theory:

- (a) At a depth of about 1700 feet in the new well of the Great Republic Oil and Paint Company (well No. 2), the drill passed through Tejon shales and entered a stratum of very heavy oil or asphaltum. The productive oil above is of medium gravity.

- (b) One mile west of the Great Republic property, a well drilled by the Hill Top Oil Company started at the surface in the Tejon formation, and at a depth of 1000 feet entered red rock and softer formations, which apparently belong to the Sespe age and normally lie above the Tejon beds. This well attempted to produce very heavy oil from the so-called Sespe beds.

The presence of asphaltum in the first mentioned well, and Sespe beds in the latter well, would indicate a northward dip of the fault plane between the Sespe and Tejon formation at this point. Under such conditions it is possible that oil has accumulated in the zone of faulting and has permeated fractured shale of Tejon age directly above the fault contact. At any rate, the presence of oil in the Tejon formation, under such conditions, opens up possibilities in an extensive belt of Tejon running east and west and bordering the fault which is the principal feature of structure on the north side of this field. This region certainly warrants detailed study of underground and surface structure. In only one other field in the district—the Simi field—is the Tejon formation known to be productive, and production in this case is obtained from the upper portion of this formation, as contrasted with the middle or lower Tejon which is productive in the Ojai field.

Due to the hard character of the Tejon strata, in contrast to the younger beds of Sespe and Vaqueros, which contain the main productive horizons in the county, it is not to be expected that the production from the older beds would be as rapid. It has been proven, however, that wells drilled into this formation produce oil on a commercial scale

for a much longer period than wells producing from the softer formations, and it is therefore possible that an investment in drilling in this area would prove profitable.

Numerous attempts have been made to obtain production in the region of Sulphur Mountain, the southern and western limits of the field. Up to the present time all efforts to obtain commercial production have met with failure. The presence of numerous large seepages will undoubtedly attract new operators to this region, especially since the advent of new oil fields recently developed at the western end of Sulphur Mountain, near the Ventura River. The possibilities of this region can not now be estimated.

#### Production and Water Conditions.

Production for the field, as reported for the fiscal year, amounts to 64,971 bbl. of oil and 148,892 bbl. of water. This is a daily average of 210.4 bbl. of oil and 408.1 bbl. of water for the field, or 6.4 per cent of oil and 12.4 bbl. of water per producing well per day, the proportion of water being 62 per cent. The production of oil reported exceeds production for the previous year by approximately 50 bbl. per day for the field.

Several wells of one of the larger companies are reported to be making from 90 to 95 per cent water. The condition of these wells should be investigated immediately, the source of the water located, and the water excluded before further damage occurs to the oil measures.

TABLE IX.  
Ojai Field.

Section, township, range.	Company	New wells		Test of shut-off		Deepen, redrill, etc.		Abandon		Supplementary	
		Noted.	Decisions.	Noted.	Decisions.	Noted.	Decisions.	Noted.	Decisions.	Noted.	Decisions.
7-4 N.-21 W.	Hill Top Oil							1	1		
7-4 N.-21 W.	Interstate Oil			1	1	1	1			2	2
8-4 N.-21 W.	Great Republic Oil and Paint			1	1						
17-4 N.-21 W.	Capital Crude Oil			1	1						
11-4 N.-22 W.	Pan-American Petroleum	1	1							1	1
14-4 N.-22 W.	Pan-American Petroleum	1	1			1	1	1	1		
15-4 N.-22 W.	Pan-American Petroleum	1	1								
12-4 N.-22 W.	Santa Maria Crude Oil			1	1						
	Totals	3	3	4	4	2	2	2	2	3	3

#### VENTURA FIELD.

Developments of great importance have taken place during the past year in this field, and undoubtedly greater interest has been aroused in the prospects of this field than in any other field in the county.

Two important additions have been made to the proved area of this field, and there are prospects for considerable increase in production for the county. Production has been obtained from two areas in the field. The first mentioned area is known as the Ventura field proper; the latter area lies in the western extension of Sulphur Mountain, where this range is cut by the Ventura River.

#### SOUTHERN PORTION OF THE FIELD.

In that portion of the field located on the Ventura anticline, only one well was started during the past year. Six other wells, however, which were reported as having commenced drilling in the year previous, are still uncompleted, and are therefore to be considered as new wells. Operating companies in this district include the Shell Company of California, with four drilling wells, the State Consolidated Oil Company, with three drilling wells and one completed well, and the General Petroleum Corporation, with two wells drilling and one well completed.

#### Geology.

All the wells drilling in this area are apparently located close to the axis of the Ventura anticline, which crosses the Ventura River about two and a half miles north of the city of Ventura. Drilling starts in beds of Fernando age, and the deepest well so far drilled (4000') has probably not yet penetrated the entire series. It may be possible, however, that the lowest formations penetrated should be classified with the Puente formation instead of the Fernando. Definite evidence as to the exact age of such formation is lacking. One company estimates the original thickness of Fernando beds in this region as being approximately 8000'.

The anticline upon which these wells are located can be traced on the surface for a distance of about twelve miles, the easterly end plunging under the Santa Clara River Valley, north of Saticoy, and the westerly end disappearing in the Pacific Ocean close to Pitas Point. The fold is mantled by the Fernando formation throughout its entire extent, typical species of the fauna of this formation being found at numerous places. The structure of the anticline, where it is cut by the Ventura River, is revealed as a simple fold, striking almost at right angles to the river, dipping uniformly on the north and south flanks at an angle of about 45° and plunging slightly towards the west.

The formations penetrated by the drill are essentially soft sands, blue and brown shales, and sandy shales. Large quantities of salt water, usually accompanied by an inflammable gas, are encountered in drilling. The water usually flows from wells in the Ventura River Valley after drilling below a depth of about 1000'. In only one well in

this area has the salt water failed to flow from the well. This is probably due to differences in elevation of approximately 350', which is roughly equivalent to an added pressure of about 150 pounds per square inch.

### Character of Oil Formations.

According to popular opinion, two oil zones have been encountered in this area to date. An upper zone, which produces oil of 56° Baumé gravity, is separated by several hundred feet from a lower oil of 30°. It seems more likely that the two so-called zones are not separate and distinct, but that the gravity of the oil becomes progressively lighter from the lower or heavier oil sands to the upper or lighter oil-bearing formations. As a proof of this latter assumption may be cited a well which was drilled and finished to a depth corresponding approximately to one-third of the distance between the two so-called zones, this well having produced a quantity of 48° gravity oil, the uppermost oil sands having been cemented off behind the 8½" casing.

Every well drilled in this field to date, except one, has failed to make a definite water shut-off above the first showing of light oil. This fact has led the operators until recently into the belief that the light oil sands carried water. It was only by the accidental freezing of a string of casing, which was being carried with heavy mud-fluid in a well, that water was shut off, temporarily at least. Subsequently an oil sand was encountered a short distance below this shut-off, which produced clean oil of very light gravity. The fact that this upper oil sand produces clean oil definitely disproves the theory advanced by several of the operators that this zone carried water. The stand taken by this department in the past has been that the top oil zone should be considered free from water until proved otherwise.

### Recent Developments.

In the proved area of this field five wells are drilling, two wells are idle, and one well is completed. The completed well was drilled by the General Petroleum Corporation on the "Barnard" lease into the upper oil formations. It is producing approximately 60 bbl. of oil of 56° gravity. Several hundred gallons of gasoline per day are extracted from gas, which is treated by an absorption plant.

The idle wells are "Lloyd" No. 1 and "Hartman" No. 1 of the State Consolidated Oil Company. Practically no work has been done at either well during the year, and without a doubt the former well is a serious menace to the upper oil-bearing formations which it has penetrated. This well encountered and logged oil-bearing formations at depths of 2300' and 2550', respectively. Water was not shut off above the first oil showing. The 6½" water string which was cemented

near the bottom of the hole collapsed, and in endeavoring to remove the casing it was found that the 6 $\frac{1}{4}$ "", 8 $\frac{1}{4}$ " and 10" casings were frozen together. Without conferring with this department in the matter of plugging the lower portion of the well, before leaving the bottom of the hole unprotected the company started shooting, putting in sixteen shots between the bottom of the well and 1900', at which point the three strings came loose. After removing about 1000' of 10", 1200' of 8 $\frac{1}{4}$ ", and 1300' of 6 $\frac{1}{4}$ ", the remainder of these strings which parted at 1900' dropped back into the hole. The company then endeavored to sidetrack at 1000' and froze the new string. Salt water has been flowing continuously from the well since shooting operations were carried on, and the possible damage to the oil measures can only be estimated. Since the future productiveness of the upper oil-bearing horizons in this area depends largely on the ability of the company to exclude water in this well from the oil-bearing formations encountered, it seems necessary and advisable that the company undertake repair work at this well without delay. The redrilling of this well, to properly protect the oil measures, may become a vital necessity in the near future, and should not be delayed until irreparable damage is done.

Of the five drilling wells in this area, the Shell Company of California is operating three, "Taylor" No. 1, "Gosnell" No. 1, and "Hartman" No. 1; the State Consolidated Oil Company is drilling two, "Lloyd" No. 2 and "Lloyd" No. 3.

The redrilling of "Lloyd" No. 2 by the State Consolidated Oil Company was carried on in conformity with the instructions issued by this bureau in Order No. 4 by State Oil and Gas Supervisor R. P. McLaughlin, dated October 31, 1917, which order was the result of a conference of commissioners and operators of this field with representatives from this department, held in Ventura on October 26, 1917. This order (which was printed in full in the Second Annual Report, Bulletin No. 82, p. 193) was issued so that possible further damage to the underground oil supply, due to the condition of the well, might be eliminated by prompt and efficient work.

The results of redrilling this well show that the old hole, through which the well blew out, was apparently followed with very little trouble to a depth of 2126', where the 10" was cemented in tight hole, water being partly shut off. Redrilling below this depth may have been into new formation. The 6 $\frac{1}{4}$ " casing was frozen at 2218', shutting off water, and this well, which had originally produced as much as 3000 barrels of sale water per day, is now pumping high gravity oil, free from water.

Well No. 3 "Lloyd," belonging to the same company, has been drilled to a depth of approximately 2800'. Very little oil has been

reported as being encountered in the upper oil horizons, and the company has proposed to deepen the well in an attempt to produce from the lower and heavier gravity oil formations. Water has never been excluded from this well, in spite of the fact that it does not flow, and there is a possibility that formations carrying light oil have been penetrated and their oil contents not recognized.

The Shell Company of California, in their well No. 1 "Gosnell," cased off all upper oil-bearing formations carrying light oil, failed to shut off water, and have been endeavoring to produce from formations lower in the oil series, which carry oil of about 30° gravity. The prospects of this portion of the zone can only be estimated at the present time, but from all indications this zone may become very productive. This well is being drilled as a prospect well, and it is the intention of the company, after having prospected the deeper oil measures, or in case other wells in the immediate vicinity obtain production from the shallow oil measures, with water shut off, to then plug the lower portion of the well and shut off water at the proper depth. Oil and water are now flowing from the well under considerable pressure, and the fact that oil would flow at all, with a water column of approximately 3200', exerting a pressure anywhere from 700 to 1400 lb. per square inch at the bottom of the hole, is sufficient evidence to warrant the assumption that there is a considerable quantity of oil in the pool under pressure great enough to make it flow.

Shell Company well No. 1 "Hartman" (Sec. 22, T. 3 N., R. 23 W., S.B.B. & M.) was completed into the upper oil horizon and the well put on pump. After landing a perforated oil string at this stage, the well made practically no fluid. Upon bailing inside the 8½" oil string, it was discovered that only about ten barrels of oil would come in, but the well would flow oil and water between the 10" water string and the 8½". For a time the well was kept bailed down to about 1900', and from eight to ten barrels of oil and about eighty barrels of water would flow from between the casings. The 8½" casing was finally pulled out and found to be collapsed. The well was then cleaned out and pumped inside the 10" casing, obtaining about 25 bbl. of oil and 300 bbl. of water per day. Subsequently the well sanded up, was cleaned out, the bottom of the hole redrilled, and 6½" perforated landed on bottom. Pumping inside the 6½" produced only water at the rate of 300 to 400 bbl. per day. By keeping the well pumped down, however, at the above rate of water production, oil would flow between the 6½" and 10" casings at the rate of 20 to 40 bbl. per day and no water.

Upon the completion of the adjoining General Petroleum Corporation well No. 1 "Barnard," production at this well dropped off to about five barrels oil per day. Redrilling was started to shut off water

somewhat above the former depth, for the purpose of testing an oil showing which had been previously passed and cemented behind the 10" casing. The attempt to exclude water proved a failure. The evidence at hand shows the conditions at this well to be rather unique. The source of the oil flowing between the casings was undoubtedly somewhat above the bottom of the hole, since no oil would enter the well through the perforated pipe. It is possible that the water pressure was lowered sufficiently to allow oil to enter the well when the well was pumped. In this case it would seem more natural for the oil to rise than to seek lower levels and enter the perforated pipe. Just how far up the hole the oil was entering is not known, but it seems probable that the source was from an oil sand logged about 40' above the shoe of the 10" water string, and that both oil and water were flowing around the shoe of this casing.

Well No. 1 "Taylor," of the Shell Company, located in Rancho San Miguelito, encountered a large volume of gas in formations which correlate with the first oil horizon. The company attempted to produce this gas without success, probably due to the fact that water was not shut off, and that the perforated pipe sanded up. After landing a string of 6½" with perforated pipe on the bottom, an attempt to produce the gas was made by bailing and swabbing the well. Very little gas was in evidence. Upon ripping the 6½" casing, however, to redrill the well, the original volume of gas was again in evidence, and it was some time before the pressure was overcome sufficiently to allow the mudding of the well. The company then redrilled this well and attempted to shut off water several hundred feet above the gas formation, to test out numerous formations which were originally logged as showing oil, but which had been cased off. Water was shut off temporarily, breaking in again after drilling 4' ahead of the casing. Having failed to shut off water, the company abandoned the idea of prospecting the upper oil formations and proposed to again pass them up and drill for deeper oil showings.

#### **Summary of Recent Operations.**

In reviewing operations in this field during the fiscal year, it should be borne in mind that the drilling conditions encountered are unusual and extremely difficult to overcome. Due to the soft character of the Fernando formation, and the presence of large volumes of salt water and gas, prospecting is very hazardous and oil showings hard to identify. The apparent lack of suitable shale bodies in which to cement or land the water string, tends to complicate the situation. Furthermore, the ability of cement to set and permanently exclude water, in the presence of the gas and salt water, which may be constantly in motion, is seriously questioned. Innumerable attempts to cement wells

in this area, and exclude water permanently, have in every case met with failure.

The writer has constantly urged the use of thick mud-laden fluid, with a tapering shoe driven in tight hole in shale, as an experiment to replace the cement method, but until very recently this idea has not found favor. The accidental shutting off of water, due to the freezing of a string of casing which was being carried in a column of thick mud, which case was mentioned previously in this report, has finally turned attention to this matter, and several companies are now proposing to try the experiment, using mud only, instead of mud and cement.

Another factor which seemingly has been a cause for failure to shut off water, is the tendency of the various companies to carry the water string down to and immediately above the first oil horizon, without first having ascertained that water-bearing formations would be encountered in such close proximity to the oil formations and possibly having penetrated excellent shale bodies at shallower depths in which a water string could be landed with better results. In perhaps one-half of the cases of failure to shut off, the cause may be directly attributed to the fact that the water string was carried down through a portion of the upper oil measures, thus adding three undesirable factors—gas, oil, and water—the latter a flowing water under normal conditions. To these drawbacks must also be added the necessity of keeping the well thoroughly mudded preliminary to cementing, in order to minimize the heavy pressure, and the subsequent impossibility of thoroughly washing the hole ahead of the cement. Under such conditions it is not surprising that so many failures have occurred.

#### **Wildcat Wells.**

The following wildcat wells are being drilled outside the limits of proved area in this field:

Shell Company of California "McGonigle" No. 1, Sec. 23, T. 3 N., R. 23 W., S.B.B. & M.

General Petroleum Corporation "Hobson" No. 1, Sec. 22, T. 3 N., R. 24 W., S.B.B. & M.

"McGonigle" well No. 1, of the Shell company, is drilling one and a quarter miles in an air line east of the productive area of this field. It is located on the eastern extension of the Ventura anticline. After reaching a depth of 2900' the well was bridged and a water string cemented at a depth of about 2800'. Upon cleaning out, the well flowed several million cubic feet of odorless, inflammable gas, and about 300 bbl. of water per day. It has reached a depth of about 3100' and no oil showings have been reported.

General Petroleum Corporation wells Nos. 1 and 2 "Hobson" are drilling on the extreme western end of the Ventura anticline near the

Pacific Ocean, and are apparently testing this portion of the anticline. As in the producing area, drilling is very difficult on account of salt water and soft sandy formations. Well No. 1 has reached a depth of about 2600', at which depth the 6½" casing was frozen and sidetracking was begun, using a mud circulator. Water has not yet been shut off in this well and no oil bearing formations reported as having been encountered. Well No. 2 has been drilled to a depth of about 1270', and has been idle for the major part of the year. Water has not been shut off in this well.

### Conclusions.

The results of drilling in the southern portion of the Ventura field, during the fiscal year, indicate that further and more extensive developments will be carried on during the coming year. Although the possibilities of the field, from a productive standpoint, have not yet been realized, due to the difficulties in handling the water situation, wells already producing from the light oil horizon have proved to the satisfaction of several operators that this zone is worthy of development alone. In addition, the opening up of deeper oil formations carrying heavier oil as in the Shell Company "Gosnell" well No. 1, the oil being accompanied by a good gas pressure, has given the field a prominent place in prospective productive value.

It is confidently expected that the solution of the water problem will shortly be found, and that soon thereafter the completion of the wells will be assured. With the finishing of the present drilling wells, and the knowledge thereby gained as to the underground structure, will come an extensive drilling campaign, which will probably affect a wide area near the anticline east and west of the Ventura River.

### NORTHERN PORTION OF VENTURA FIELD.

During the past year a new company, called the New Mexico Oil Company, has succeeded in proving up new territory which is just east of the Ventura River and several miles west of Sulphur Mountain. The new wells are located in Rancho Ex Mission de San Buena Ventura, and would fall in Sec. 33, T. 4 N., R. 23 W., S.B.B. & M., if subdivided into sections. This company is not the first company which has drilled in this vicinity. Starting in seepages of oil which occur about half a mile northwest of the group of wells now producing on the property of the New Mexico Oil Company, four wells have been drilled in what is known as Jennings Canon. The first well is reported to have been drilled by the Philadelphia California Petroleum Company in the very early days of oil development in California, probably between 1865 and 1870. Neither maps nor records give a clue to the history of this well. The iron casing is still visible at the surface, and heavy oil oozes out.

In the year 1900 two wells were drilled by the San Buena Ventura Oil Company No. 2, being only a short distance from the well drilled by the Philadelphia California Petroleum Company 300' south of the Dixie National rig now standing. No. 1 was located on the property of J. Hollingsworth, near what would be the southeast corner of Sec. 32, T. 4 N., R. 23 W., S.B.B. & M., if subdivided. No. 1 was drilled to a depth of 1300', and no oil being found, was abandoned. No. 2, which was started in an oil seepage, was drilled to a depth of 300', only traces of oil being encountered. It was unproductive, and therefore abandoned.

In 1901 or 1902 the Constitutional Oil Company drilled one well in the group around the Philadelphia California Petroleum Company well in Jennings Canon. It was located 300' north of the San Buena Ventura well No. 2. After drilling to a depth of 400', a production of only about four barrels of oil per day was obtained, and the well was therefore abandoned.

The last well to be drilled in this group was drilled by the Dixie National Oil Company in 1908. It was located  $11\frac{1}{2}$  feet south of the well drilled by the Constitutional Oil Company. It was drilled to a depth of 720 feet, encountering oil between depths of 300' and 350'. The production amounted to only three to four barrels of 16° gravity oil per day, and all casing was therefore pulled out, no plugging having been done to protect the oil from a larger quantity of water also encountered. The rig over this well is still standing.

#### **New Mexico Oil Company.**

The amount of work done by this company during the past year is shown by the drilling of seven shallow wells near the center of the property. The productive formations from which this company derives its oil have never before been tested, and with the exception of the small producing wells mentioned above, no production has been obtained from this part of the county.

The work of drilling commenced on January 10, 1918. Brown shale was encountered to a depth of 48', at which depth oil of 29° Baumé entered the well and stood within 15' of the surface. Another hole was then spudded in, only four feet distant, in which oil was encountered at the same depth. The original hole was then deepened to 220', and oil reported at depths of 128' and 175'. Subsequently six other wells were drilled and formations encountered similar to the formations penetrated by well No. 1. All production so far has been obtained from seams in brown shale. Very little water is encountered above a depth of 600'. At this depth, however, considerable water is found in several wells, and it has become necessary to plug the lower portion of a number of the wells.

**Geology.**

A study of the surface geology near the wells of the New Mexico Oil Company shows that the wells are located a short distance south of the axis of an anticline which is here developed in the Monterey formation. This anticline is very nearly parallel to the fault which marks the contact between the Fernando and the Monterey formations, and which can be plainly seen about one-half mile to the south. The direction of the anticline at this point is N. 50° E., and the dip on the north and south flanks approximately 50° close to the axis. The north flank of the anticline soon develops into a syncline, so that the exact location of the two structures may be easily confused unless care is taken in mapping. The anticline has been followed some distance west and one mile east from the camp of the New Mexico Oil Company. Toward the east it swings to the south, roughly parallel to the major fault mentioned above.

The oil is obtained from shale which has not been eroded at the surface. This probably accounts for the high gravity of the oil. Due to the fractures in the shale, some oil has reached the surface from the shallow oil horizon, and numerous seepages occur at this point and further east close to the axis of the anticline. Further to the south are exposed oil sands, which at one time covered the anticline. Large seepages are found at several localities, the oil originating from these exposed oil sands. There is a possibility, therefore, that commercial production of a heavier oil may be obtained on this property between the region of present development and the fault which marks the southerly limit of the Monterey.

**Future Developments.**

At the present time two new wells are drilling some distance north and east of the New Mexico Oil Company's property, one by H. L. Hayes and the other by the Riva Oil and Gas Company.

The Hayes well is located practically on the axis of the New Mexico anticline, and about half a mile east of the latter company's well. It would seem that the prospects for obtaining oil in this locality are as favorable as on the New Mexico lease, since structural conditions and the oil formations are very nearly the same.

The wildcat well being drilled by the Riva Oil and Gas Company is located near the south line of Sec. 27, T. 4 N., R. 23 W., S. B. B. & M., and about one mile northeast of the Hayes well. An examination of the geology of this vicinity shows that the well is located on the north flank of the syncline which parallels the New Mexico anticline on the

north. It is, therefore, about half a mile north of the New Mexico anticline, and any production obtained at this point will no doubt open up much larger areas in this field for development.

#### Production and Water Conditions for the Entire Field.

The production of this field for the fiscal year amounted to 17,848 bbl. of oil and 104,228 bbl. of water, or a daily production of 161.8 bbl. of oil and 527.6 bbl. of water for the field. The production per producing well per day was 18 bbl. of oil and 58.6 bbl. of water, or 76.7 per cent water.

Of the 17,848 bbl. of oil produced by the field during the year, approximately one-half was produced from the New Mexico anticline in a period of three months. The water produced in this portion of the field amounted to only 1 per cent, so that the correct percentage of water for the Ventura field proper is 91 per cent. This will serve as an idea of the water situation on the properties of the Shell Company of California, the State Consolidated Oil Company, and the General Petroleum Corporation, which companies are the only operators in the Ventura field proper. As previously mentioned in this report, it is hoped that, during the coming year, the water troubles will be overcome by new methods and the amount of oil production greatly increased.

TABLE X.  
Ventura Field.

Section, township, range.	Company	New wells		Test of shut-off		Deepen, redrill, etc.		Abandon		Supplementary	
		Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.
16-3 N.-23 W.	Dabney & Lloyd							1	1		
21-3 N.-23 W.	Shell Company of California			1	2	5	5			8	7
22-3 N.-23 W.	Shell Company of California					2	2				
23-3 N.-23 W.	Shell Company of California			1						1	1
22-3 N.-23 W.	State Consolidated Oil Company	1	1		2					5	4
22-3 N.-23 W.	General Petroleum Corporation				1						
22-3 N.-24 W.	General Petroleum Corporation			1						1	1
33-4 N.-23 W.	New Mexico	7	7							1	
33-4 N.-23 W.	H. L. Hayes	1	1								
	Totals	9	9	6	5	7	7	1	1	16	13

#### MISCELLANEOUS FIELDS.

Drilling operations in progress during the fiscal year, outside of the producing fields in the county, were carried on by the companies as shown in Table XI.

The two wells drilled by the St. Helens Petroleum Company on the Lanning and Lewis Ranchos, respectively, T. 2 N., R. 21 W., S. B. B.

& M., located a short distance south of the town of Camarillo, were carried to shallow depths only. The penetration of formations described as "Metamorphic" led to a discontinuance of drilling and the conversion of the wells into water wells. No oil is reported as having been encountered.

The well being drilled by Joseph B. Dabney is located on the axis of a plunging anticline approximately one and a half miles north of the town of Camarillo. Drilling starts in beds of upper Fernando or San Pedro formations. The dip on either flank of the anticline is approximately  $30^{\circ}$  and the axis at this point is noticeably plunging toward the west. At the present writing the drill has apparently passed out of the Fernando formation and entered beds of probable Puente age. A slight showing of oil was noticed near the contact of the two formations. As the beds which underlie the Puente formation are exposed further up the anticline and in South Mountain to the north, it is probable that a continuance of drilling will expose the Vaqueros formation, which is here interbedded with conglomerate and some basalt, and possibly the upper portion of the Sespe formation. There is undoubtedly a marked unconformity between the Fernando and Puente beds, since the Puente is entirely missing where the Vaqueros is exposed on the rising end of the dome about three miles east of the well.

The True Oil Company is still engaged in the deepening of its well in the Cuyama Valley in Sec. 2, T. 9 N., R. 24 W., S. B. B. & M., near the northwest corner of the county and about 22 miles south of Maricopa. Bulletin No. 621-M issued by the United States Geological Survey on "The Geology and Oil Prospects of Cuyama Valley, California," describes the conditions at this well, which was originally started and drilled to a depth of 1800 feet by the Webfoot Oil Company, as follows:

"The Webfoot well, in a narrow gulch on the north side of Ballinger Cañon, in the S. W. quarter, section 2, Township 9 N., Range 24 W., was started about 1905, and drilling continued intermittently for a number of years. It is said to have reached a depth of 1800 feet without encountering any oil. The well starts in nearly vertical beds of brown sandy shale of the Monterey group."

The conditions, as reported in this article, have been verified by the writer and found to be practically as stated. Drilling during the past year has not disclosed oil in commercial quantities.

Table XI, which follows, shows the notices received and reports issued for miscellaneous fields in the district during the fiscal year.

**TABLE XI.**  
**Miscellaneous.**

Section, township, range-----	Company	New wells		Test of shut-off		Deepen, redrill, etc.		Abandon		Supplementary	
		Notices-----	Decisions-----	Notices-----	Decisions-----	Notices-----	Decisions-----	Notices-----	Decisions-----	Notices-----	Decisions-----
---2 N.-21 W.	St. Helens Petroleum-----	2	2								
---2 N.-21 W.	Joseph B. Dabney-----	1	1	1							
2-9 N.-24 W.	True Oil-----					1					
	Totals-----	3	3	1		1					

### DECISIONS.

#### PIRU FIELD.

T. 3 N., R. 18 W., S.B.B. & M.

##### SECTION 1.

Beatty Oil and Development Co.

Well No. 2, abandon. P 2-121.

Approved proposal of the company to abandon this well as outlined in the notice of abandonment, specifying depths at which cement plugs should be placed and from which casing was to be pulled. In attempting to pull the 8½" casing, this casing was ripped in several places. More oil was discovered coming from behind the pipe and the well was put on the beam again with considerable increase in production.

T. 4 N., R. 18 W., S.B.B. & M.

##### SECTION 8.

Diamond Valley Oil Co.

Well No. 4, supplementary to drill. P 2-28.

Approved proposal of the company relative to change of shut-off depth previously proposed due to encountering oil at a shallower depth than anticipated.

Well No. 4, shut-off. T 2-18.

Test of water shut-off approved.

##### SECTION 32.

Midway Supply Co.

Well No. 1A, Cameron, abandon. P 2-45.

Recommended the company abandon this well as proposed.

Well No. 1A, Cameron, supplementary to abandon. P 2-73.

After receipt of history of abandonment, the work as completed having conformed to original proposal, final approval was given.

Well No. 1, Cameron, abandon. P 2-44.

Recommended plugging in shale formation with cement between specified depths, final approval to be given upon receipt of completion report.

Well No. 1, Cameron, supplementary to abandon. P 2-74.

Upon receipt of final report of abandonment, the work having been carried out as recommended, final approval was given.

Well No. 2, Cameron, abandon. P 2-43.

Recommended plugging with cement in shale bodies between certain specified depths. Recommendation differed from the proposal in location of plugs to be

placed in the well. Final approval contingent upon receipt of completion report showing work done as recommended.

Well No. 2, Cameron, abandon—supplementary. P 2-75.

Final approval of abandonment given as work was done according to recommendation.

#### SECTION 33.

C. Victor Stephens.

Well No. 1, Winnipeg, abandon. P 2-25.

Approved method of abandonment as outlined in the proposal, determination to be made that cement plugs set properly before proceeding with subsequent work.

Well No. 2, Winnipeg, abandon. P 2-26.

Approved method of abandonment as outlined in the proposal in same manner as Well No. 1.

Well No. 3, Winnipeg, abandon. P 2-27.

Approved method of abandonment as outlined for Well No. 1.

#### SECTION 34.

C. Victor Stephens.

Well No. 1, Eureka Cañon Syndicate, abandon. P 2-18.

Approved the company's method of abandonment.

Well No. 2, Eureka Cañon Syndicate, abandon. P 2-85.

Recommended plugging with cement in shale formation between certain specified depths. Recommendation differed somewhat from the proposal in respect to the location of plugs. Required final report of work done before approval could be given.

Well No. 3, Eureka Cañon Syndicate, abandon. P 2-19.

Approved the company's method of abandonment as outlined in the proposal.

#### SECTION 36.

Beatty Oil and Development Co.

Well No. 3, redrill. P 2-8.

The company submitted a proposal which was approved by this report looking toward the elimination of water which had broken in from the top, by cutting out the 8 $\frac{1}{4}$ " casing and tamping outside the 6 $\frac{1}{2}$ " with the 10" casing, from a depth of 400'. The work was successfully carried out as proposed according to later report from the company.

Well No. 4, drill. P 2-106.

The proposal to drill was rejected owing to the lack of definite location of the well on notice to drill.

Well No. 4, drill. P 2-107.

Information which was lacking in notice to drill was filed and approval of the company's proposal was given to shut off water at a depth of about 450'.

Well No. 4, test of shut-off. T 2-64.

Test of water shut-off approved as satisfactory.

#### SIMI FIELD.

T. 3 N., R. 18 W., S.B.B. & M.

#### SECTION 32.

Doheny-Pacific Petroleum Co.

Well No. 2, Scarab, drill. P 2-2.

The company stated that this was a wildcat well and no estimate was given for depth of shut-off or oil sands. Recommended that each string landed below a depth of 100' be cemented.

Well No. 2, Scarab, shut off. T 2-15.

Test of water shut-off satisfactory for 12 $\frac{1}{2}$ " cemented at 1205'.

Well No. 2, Scarab, shut off. T 2-27.

Water not shut off with 10" casing. Recommended further tests, recementing, or use of another water string.

## Doheny-Pacific Petroleum Co.—Continued.

Well No. 2, Scarab, supplementary. P 2-78.

Approved proposal to cement 8½" at a lower depth to shut off water.

## SECTION 35.

## Doheny-Pacific Petroleum Co.

Well No. 6, deepen. P 2-122.

Approved proposal to deepen the well.

Well No. 16, drill. P 2-33.

Approved proposal of the company to shut off water at a depth of about 600'.

Well No. 16, supplementary. P 2-47.

Approved proposal to shut off at a lower depth.

Well No. 16, shut off. T 2-20.

Test of water shut off with 8½" approved.

Well No. 16, alter casing. P 2-58.

Approved proposal to pull 12½" and 10" casings.

Well No. 17, drill. P 2-34.

Recommended water shut-off at a depth of about 600' as proposed.

Well No. 17, supplementary. P 2-55.

12½" was cemented at 534' and water encountered at 537'. Approved proposal to cement 10" casing through water formation at a depth of about 700'.

Well No. 17, alter casing. P 2-56.

Approved proposal to remove 12½" and 10" casings.

Well No. 17, shut off. T 2-25.

Test not conclusive. Water entering the well.

Well No. 17, supplementary. P 2-64.

Approved proposal to set anchor packer to determine source of water.

Well No. 17, supplementary. P 2-67.

Recommended plugging bottom of the hole before cutting 8½" casing to carry same for lower shut-off.

Well No. 17, supplementary. P 2-70.

As 8½" was removed without cutting, approved proposal to ream old hole and cement at 1045'.

Well No. 17, shut off. T 2-40.

Final approval of test of water shut-off.

Well No. 18, drill. P 2-39.

Approved company's proposal to shut off water at a depth of about 500'.

Well No. 18, shut off. T 2-26.

Test of water shut off approved as satisfactory.

Well No. 19, drill. P 2-82.

Approved casing landing at a depth of 613'. No water encountered above this depth.

Well No. 19, shut off. T 2-37.

Results of test showed no water entering the well.

Well No. 20, drill. P 2-81.

Recommended that water be shut off at a depth of about 550' instead of 800' as proposed.

Well No. 20, supplementary. P 2-90.

Approved supplementary proposal to shut off water at a depth of about 500'.

Well No. 20, shut off. T 2-43.

Test of water shut-off at 510' satisfactory.

Well No. 20, abandon. P 2-137.

Recommended abandonment and plugging with two alternatives depending upon amount of casing which could be removed.

Well No. 20, supplementary. P 2-146.

Approved proposal to suspend work of abandonment and allow the well to produce gas.

## Doheny-Pacific Petroleum Co.—Continued.

Well No. 21, drill. P 2-135.

Notice to drill stated the department would receive further information as drilling progressed but no further information was received until casing was landed and notice of test of water shut-off filed. Approval was given to continue drilling.

Well No. 21, shut off. T 2-60.

Test of shut-off approved.

Well No. 22, drill. P 2-134.

No estimate was given as to depth of water shut-off. Recommended shutting off water by mudding or cementing at a depth of about 800'.

Well No. 22, shut off. T 2-71.

Small amount of salt water entering the well. Approved proposal to deepen 100' and test again.

## SECTION 36.

## Doheny-Pacific Petroleum Co.

Well No. 10, supplementary to drill. P 2-126.

Because this well was already drilled through the first oil horizon before the notice was received and on account of mechanical difficulties involved in backing up to test the horizon, approval was given to mud the formations and land casing at a depth of about 750', the possibilities of the horizon to be prospected with a new well in this area.

Well No. 10, shut off. T 2-55.

Test of water shut-off approved.

Well No. 23, drill. P 2-147.

Recommended that water be shut off at a depth of about 500' instead of 700' as proposed.

## Santa Susana Oil Corporation.

Well No. 1, deepen. P 2-149.

The proposal of the company to deepen as outlined was satisfactory.

Well No. 7, new well. P 2-111.

Approved company's proposal as to depth of water shut-off.

Well No. 7, supplementary to drill. P 2-123.

Approved supplementary proposal relative to change in shut-off depth.

Well No. 7, shut off. T 2-61.

Water shut off with 10" casing. Test approved.

Well No. 8, new well. P 2-138.

Approved company's proposal as to depth of water shut-off.

Well No. 8, shut off. T 2-65.

Water not shut off. Approved proposal to loosen water string and carry to lower depth for shut-off.

Well No. 8, shut off. T 2-67.

Water shut off with 12½" casing. Test approved.

## BARSDALE FIELD.

T. 3 N., R. 19 W., S.B.B. &amp; M.

## SECTION 3.

## Home Ranch Petroleum Co.

Well No. 1, deepen. P 2-77.

Approved company's proposal to deepen this well about 100'.

Well No. 1, shut off. T 2-58.

This well produces oil, free water and emulsion. Reports from the company indicated that the emulsion carried no water in suspension. A production test was witnessed at the well and the total amount of water produced was reported. This report differed from the company's estimate mainly because the emulsion upon distillation test showed 62% water. Source of the water was not determined.

## Calumet Oil Co.

Well No. 8, commence drilling. P 2-61.

Recommended that water be shut off fifty feet higher than proposed, in order that the depth of shut-off might be uniform stratigraphically with shut-off depth in neighboring wells.

Well No. 8, shut off. T 2-41.

Water was shut off at a lesser depth than proposed or recommended. Test of shut-off approved.

Well No. 9, shut off. T 2-33.

The report states that the company shut off water in this well 200' feet lower than proposed. The department was not notified of change in proposal. Data on file indicates that water was carried down into the top of the second oil zone. Approval was given to proceed with drilling, condition of well being satisfactory, providing no damage should ensue as a result of lower shut-off.

## SECTION 4.

## Montebello Oil Co.

Well No. 66, deepen. P 2-11.

Approved the company's proposal to deepen the well.

Well No. 66, shut off. T 2-29.

Production test, witnessed after well was deepened and bottom water plugged off. Test indicated that not all water was shut off. Recommended further pumping to determine whether or not the amount of water would increase, and advised further plugging if the water did not decrease.

Well No. 81, plug well. P 2-5.

Approved company's proposal of plugging the well.

Well No. 81, supplementary-deepen. P 2-51.

Approved company's proposal to shut off water with 6½" casing above third oil zone to test out same.

Well No. 81, shut off. T 2-44.

The company stated that 6½" casing was cemented above third oil zone and water not shut off. The third oil zone was then penetrated and tested with water not shut off. The hole was then plugged up to within 2' of the 6½" casing when the above-mentioned test was witnessed. Test indicated that oil was plugged off and water was entering the well around the shoe of the 6½" casing.

Well No. 81, redrill. P 2-99.

Recommended mudding the bottom of the well under pressure before abandoning the lower portion of the hole.

Well No. 81, supplementary—redrill. P 2-103.

Upon receipt of additional information contained in supplementary notice, recommended the well be not mudded as provided in P 2-99 and specified placing certain cement plugs.

Well No. 82, shut off. T 2-2.

Production test indicated that water was shut off. Test approved.

Well No. 87, shut off. T 2-1.

Test showed water had risen 119' while standing for test. Recommendations were made concerning plugging the bottom of the well and conducting further tests.

Well No. 87, shut off. T 2-4.

Result of test showed that water was entering the well at the rate of 1' per hour, source not determined. Approved proposal to deepen and shut off water lower down.

Well No. 87, shut off. T 2-9.

Water was shut off with 10" casing. Test approved.

Well No. 87, shut off. T 2-36.

Bottom water was encountered and successfully excluded from the well by plugging the bottom of the well and cementing the 8½" casing. Test approved.

## Montebello Oil Co.—Continued.

Well No. 101, shut off. T 2-10.

Test of water shut-off approved.

Well No. 101, shut off. T 2-16.

Water not shut off. Recommended additional tests.

Well No. 101, shut off. T 2-32.

Pumping test showed oil and water to be entering the well. Upon deepening the well and before landing and cementing a water string above the second oil zone, recommended mudding the well under pressure to protect the oil formations open in the well at the time of test.

Well No. 102, plug bottom. P 2-14.

Approved a proposal from the company to plug the lower portion of the well to locate the source of the water. Recommended plugging at certain depths in case the source was not determined by the first plug.

Well No. 102, supplementary—redrill. P 2-57.

Approved proposal to do further plugging under changed conditions.

Well No. 102, supplementary—recement. P 2-66.

Proposal to recement approved.

Well No. 102, supplementary—recement. P 2-76.

Proposal approved.

Well No. 102, supplementary—redrill. P 2-72.

Proposal to redrill, carrying the 8 $\frac{1}{4}$ " casing to a lower depth to shut off water was satisfactory.

Well No. 102, supplementary—recement. P 2-127.

Water not shut off. Proposal to recement approved.

Well No. 102, supplementary—redrill. P 2-150.

Approved proposal to loosen the 8 $\frac{1}{4}$ " and carry to lower depth for shut off, specifying mudding of portion of top of second oil zone cased off.

Well No. 103, commence drilling. P 2-24.

Approved company's proposal to shut off water at a depth of 1250'.

Well No. 103, supplementary to drill. P 2-46.

Upon complaint of a neighboring operator the question of depth of water shut-off was again considered and as a result of conference between these two companies and a representative of this department, a recommendation was made to shut off water at a shallower depth in order to protect formations which were open in adjoining wells and continue the policy of uniform stratigraphic shut-off.

This report supplements Report No. P 2-24, shown above.

Well No. 103, shut off. T 2-38.

The well was bridged back 100' to cement the water string as requested in Report No. P 2-46. Water was shut off and test approved.

Well No. 103, shut off. T 2-51.

An additional shut-off was made in this well at a lower depth, although no further water formations were encountered. Test showed no fluid entering the well.

Well No. 109, shut off. T 2-45.

Pumping test. Results not conclusive. This test was witnessed for plugging off bottom water after perforating the oil string.

Well No. 109, redrill. P 2-101.

Approved proposal of the company to abandon the lower portion of the well.

Well No. 109, supplementary—redrill. P 2-120.

Approved proposal to pull out 8 $\frac{1}{4}$ " and make production test.

Well No. 109, shut off. T 2-57.

Result of pumping test demonstrated that water was successfully excluded from the well by plugging in the bottom.

Well No. 113, shut off. T 2-19.

Water shut off above the recently discovered third oil zone was approved as satisfactory.

## SECTION 5.

Petroleum Midway Co., Ltd.

Well No. 1, Waddle-Jenkins, new well. P 2-59.

Proposal contained no estimate for depth of water shut off. Recommended that water be shut off above oil-bearing formations if found by bridging back and cementing a string of casing.

Montebello Oil Co.

Well No. 1, Elkins, abandon. P 2-92.

Approved method of abandonment proposed by the company, specifying testing by a representative from this department, of cement plugs placed in the well.

Well No. 1, Elkins, supplementary—abandon. P 2-130.

Final approval of abandonment given, the work having been carried out as proposed.

## SECTION 6.

Montebello Oil Co.

Well No. 1, Burson, abandon. P 2-148.

Approved proposed method of abandonment, specifying shooting and plugging between certain depths and testing of all plugs.

Well No. 2, Burson, abandon. P 2-128.

Recommended plugging between certain depths not included in the proposal. Recommendations were based upon data obtained by the construction of a peg model of this field by this office, which information was not available at the time of filing this notice.

T. 3 N., R. 20 W., S.B.B. & M.

## SECTION 12.

Union Oil Co. of California.

Well No. 15, shut off. T 2-34.

No water was reported to have been encountered in drilling this well. A bailing test was witnessed upon perforating an oil string and testing for productiveness. Test showed a small amount of oil and water entering the well and indicated that the water was return drilling water. For more definite information a production test was called for 60 days after completion.

Wm. Z. McDonald.

Well No. 1, West Huasna, abandon. P 2-21.

Recommended certain tests to determine the condition of the well and required additional information before approving its abandonment.

Well No. 1, West Huasna, shut off. T 2-13.

This test was witnessed as requested in our report No. P 2-21 to determine the condition of the well. A small amount of water and very little oil entered the well while standing for test. Test was made by bailing down inside of a perforated oil string.

Well No. 1, West Huasna, abandon. P 2-29.

The information requested in Report P 2-21 having been filed, the proposal to abandon the well was approved and the method to be followed in abandonment was outlined. Final report of work done was requested.

Well No. 1, West Huasna, supplementary—abandon. P 2-48.

Due to changed conditions, the 8½" casing having parted, a new proposal was entered and approved. Final report requested.

Well No. 1, West Huasna, supplementary—abandon. P 2-65.

Upon receipt of final report of work done, the work having been carried out as proposed, final approval of abandonment was given.

Well No. 2, West Huasna, abandon. P 2-22.

Outlined method of abandonment specifying plugging with cement in certain shale bodies.

Well No. 3, West Huasna, abandon. P 2-23.

Method of abandonment outlined and certain cement plugs required to be placed in the well.

**SESPE FIELD.**

T. 4 N., R. 19 W., S.B.B. &amp; M.

**SECTION 6.**

Sudden and Emslie.

Well No. 4, redrill. P 2-42.

Proposal was rejected, logs of wells on this property not having been filed.

Well No. 4, redrill. P 2-50.

All information available having been filed regarding the logs of wells on the property, the proposal as outlined was approved. The log of this well gave only its casing record. Requested that the company keep a record of all work done on the well and file a history of operations when completed.

Well No. 4, abandon. P 2-100.

Recommended certain tests to locate source of water entering the well before abandonment in order that it might be properly plugged.

Well No. 4, supplementary—abandon. P 2-142.

Approved method proposed to abandon the well under changed conditions. Rig timbers and derrick only to be moved.

Well No. 4, shut off. T 2-66.

Test witnessed to determine the results of plugging the bottom of the well in abandonment, to prevent the downward passage of water into oil-bearing formations. Test satisfactory.

**SECTION 20.**

Oak Ridge Oil Co.

Well No. 1, Faulkner, abandon. P 2-91.

Outlined method of abandonment and requested final report when work was completed.

Well No. 1, Faulkner, supplementary—abandon. P 2-97.

Approved slight change in method of abandonment due to changed conditions arising during operations.

Well No. 1, Faulkner, supplementary—abandon. P 2-131.

Final approval of abandonment given, final report having been received and work having been carried out as recommended.

T. 4 N., R. 20 W., S.B.B. &amp; M.

**SECTION 1.**

Kentuck Oil Lease.

Well No. 7, Kentuck, shut off. T 2-56.

This well was finished and producing without a test for water shut-off having been witnessed by this department. Consequently a production test was called for and final approval of water shut-off given upon the results of this test.

T. 5 N., R. 19 W., S.B.B. &amp; M.

**SECTION 33.**

White Star Oil Co.

Well No. 16, shut off. T 2-6.

Test of water shut-off approved as satisfactory.

T. 5 N., R. 20 W., S.B.B. &amp; M.

**SECTION 23.**

Big Sespe Oil Lease.

Well No. 8, commence drilling. P 2-30.

The method of drilling this well as outlined was satisfactory.

Well No. 8, shut off. T 2-39.

Results of test showed water to be shut off with 15½" casing.

Well No 8, shut off. T 2-50.

Results of test showed additional water encountered to have been shut off with 12½" casing.

## SOUTH MOUNTAIN FIELD.

T. 3 N., R. 20 W., S.B.B. &amp; M.

## SECTION 17.

United Oil Company.

Well No. 2, shut off. T 2-3.

Water not shut off. Recommended further bailing tests.

Well No. 2, shut off. T 2-5.

After continued bailing, water was practically exhausted and approval given to continue drilling.

Well No. 2, shut off. T 2-22.

This test was witnessed in conjunction with the following test to determine whether water entering the well was coming from the bottom of the well or around the 6½" casing. The bottom of the hole being plugged for this test, the water rose only about 25'.

Well No. 2, shut off. T 2-23.

The result of this test together with test reported above (T 2-22) showed that after drilling out the plug in the bottom of the well, water rose to its original level (526' from surface) demonstrating that the source of the water was below the 6½" casing.

Well No. 2, alter casing. P 2-62.

Approved proposal to loosen the 6½" casing and carry same below source of water. Well No. 2, supplementary—deepen. P 2-79.

Proposal of the company to plug in casing left in the bottom of the well and sidetrack same, prospecting for oil measures, was approved.

## SECTION 18.

Santa Paula Oil Co.

Well No. 1, deepen. P 2-32.

Approved proposed method of deepening.

Well No. 1, deepen. P 2-105.

Approved further deepening of the well.

Well No. 2, Santa Paula, deepen. P 2-36.

Recommended that the company deepen the well as proposed.

Well No. 2, Santa Paula, deepen. P 2-110.

Approved method of further deepening.

Well No. 4, Santa Paula, commence drilling. P 2-71.

Approved depth of shut-off as proposed.

Well No. 4, Santa Paula, shut off. T 2-52.

Water shut off. Test approved.

Well No. 6, Santa Paula, new well. P 2-145.

Recommended that water be shut off 125' lower than proposed.

Oak Ridge Oil Co.

Well No. 1, Willard, shut off. T 2-17.

Results of production test indicated that no water was entering the well. Test approved.

Well No. 1, Willard, deepen. P 2-54.

Approved method of deepening.

Well No. 1, Willard, shut off. T 2-54.

Bailer brought up emulsion. Deferred test until completion when production test will be taken.

Well No. 2, Willard, deepen. P 2-84.

Proposed method of deepening approved.

Well No. 2, Willard, supplementary—test. P 2-156.

Approved proposal to defer test on landing of casing until completion by taking production test after gas pressure has subsided.

Well No. 3, Willard, supplementary—recement. P 2-7.

Proposal to loosen water string and cement at lower depth on account of additional water encountered, was approved.

## Oak Ridge Oil Co.--Continued.

Well No. 3, Willard, shut off. T 2-8.

Test of water shut-off satisfactory.

Well No. 3, Willard, deepen. P 2-104.

Approved method of deepening.

Well No. 4, Willard, shut off. T 2-69.

Water shut off. Test satisfactory.

Well No. 5, Willard, new well. P 2-12.

Approved proposed depth of water shut-off.

Well No. 5, Willard, redrill. P 2-109.

Proposal to loosen 12½" water string to cement at a lower depth to shut off additional water encountered, was approved.

Well No. 5, Willard, shut off. T 2-53.

Test of water shut-off approved.

Well No. 7, Willard, new well. P 2-37.

Approved proposed depth of water shut-off.

Well No. 7, Willard, shut off. T 2-24.

Test of water shut-off satisfactory.

## SECTION 29.

## Hondo Oil Co.

Well No. 1, commence drilling. P 2-15.

Wildcat well. Recommended that each string landed be cemented. Information requested during progress of work.

Well No. 1, shut off. T 2-28.

Test of water shut-off satisfactory.

Well No. 1, abandon. P 2-136.

Recommended method of abandonment, specifying certain plugging in bottom of hole and on top of 10" casing left in the hole. Required completion report, showing work done in abandonment.

T. 3 N., R. 21 W., S.B.B. & M.

## SECTION 13.

## Oak Ridge Oil Co.

Well No. 1, Yale Richardson, shut off. T 2-12.

Water shut off with 10" casing. Test approved.

Well No. 1, Yale Richardson, shut off. T 2-48.

Test witnessed of landing of casing as a precaution against encountering bottom water. Test showed no fluid to be entering the well.

Well No. 1, Yale Richardson, shut off. T 2-68.

Well tested for results of plugging bottom of well. Test not conclusive. Production test to be taken 60 days after completion of the well.

Well No. 1, Harvey, shut off. T 2-7.

Water shut off with 12½" casing. Test satisfactory.

Well No. 1, Harvey, deepen. P 2-98.

Approved proposed method of deepening the well.

Well No. 3, Harvey, commence drilling. P 2-129.

Report delayed until completion of peg model of this field. Casing was landed for water shut-off before report was written. Depth of shut-off was approved on report of shut-off shown below.

Well No. 3, Harvey, shut off. T 2-63.

Results of test indicate water shut off. Test satisfactory.

Well No. 1, Louis Richardson, deepen. P 2-124.

Proposed method of deepening was satisfactory.

## H. P. Oates.

Well No. 1, commence drilling. P 2-4.

Approved proposed depth of water shut-off.

**Union Oil Co. of California.**

Well No. 1, Oates or Crane, supplementary to drill. P 2-49.

Supplements and amends Report P 2-4. Recommended water shut-off above oil-bearing formations encountered in drilling.

Well No. 1, Crane, shut off. T 2-62.

All water not excluded at time of test. Recommended continuance of drilling and cementing of water string lower down. Since engineering data on file in this office indicated additional water-bearing formations would be encountered. Additional water was encountered as predicted.

**SECTION 14.****Oak Ridge-Oil Co.**

Well No. 1, George Richardson, new well. P 2-140.

Development in this area not sufficient to determine in advance depth at which water should be shut off. Recommended that water should be shut off above oil-bearing formations, if encountered, by bridging back and cementing a string of casing.

Well No. 1, Frank Richardson, new well. P 2-139.

Not sufficient data at hand to indicate depth at which water should be shut off as this is a wildcat well. Recommended that water be shut off above oil-bearing formations, if encountered, by bridging back and cementing a water string.

**SANTA PAULA FIELD.**

T. 4 N., R. 20 W., S.B.B. & M.

**SECTION 18.****Timber Cañon Syndicate.**

Well No. 1, shut off. T 2-49.

The department was not notified to witness test of water shut-off until after the well had been completed and had been producing some time. While the well was being prepared to deepen, a bailing test was secured, the results of which indicate that no water is entering the well.

Well No. 1, deepen. P 2-114.

Method of deepening the well as outlined was approved.

**SECTION 20.****Santa Clara Oil and Development Co.**

Well No. 1, shut off. T 2-46.

Results of test show water to be shut off. Test satisfactory.

**SECTION 29.****Marsard and Jameson.**

Well No. 1, commence drilling. P 2-35.

The company made no estimate as to depth of water shut-off, since this is a wildcat well. Proposal to keep this office informed during drilling and take up the matter of water shut-off at a later date was approved.

T. 4 N., R. 21 W., S.B.B. & M.

**SECTION 22.****American Ventura Oil Co.**

Well No. 10, shut off. T 2-31.

Result of test showed water to be shut off and test was approved as satisfactory.

T. 4 N., R. 22 W., S.B.B. & M.

**SECTION 25.****Saltmarsh Cañon Oil Co.**

Well No. 20, commence drilling. P 2-113.

The method of drilling this well as outlined was satisfactory.

## OJAI FIELD.

T. 4 N., R. 21 W., S.B.B. &amp; M.

## SECTION 7.

Hill Top Oil Co.

Well No. 1, abandon. P 2-3.

Outlined method of abandonment, specifying cement plugs between certain depths. Required that completion report be filed.

Interstate Oil Co.

Well No. 1, Hill Top, test plug. T 2-21.

After testing cement plug, which had been placed during the work of abandonment, plug was found to be soft. Supplementary notice to discontinue abandonment and attempt to drill the well to further oil sands, was filed, and this test was therefore approved as satisfactory in order that the work of deepening could proceed.

Well No. 1, Hill Top, supplementary, redrill. P 2-63.

Instead of abandoning the well which work had already been started, the company proposed to redrill the well and attempt to obtain production. The proposal was approved as outlined.

Well No. 1, Hill Top, redrill. P 2-94.

Proposal to redrill under changed conditions was approved.

Well No. 1, Hill Top, supplementary, redrill. P 2-119.

Approved supplementary proposal to shut off water above first oil sand encountered and test out upper zone, after plugging bottom of well.

## SECTION 8.

Great Republic Oil &amp; Paint Co.

Well No. 2, shut off. T 2-47.

The department was not called upon to witness test of water shut-off at the time of landing casing for this purpose. Accordingly a test was called for, the water bailed out to bottom and a column of oil left in the hole to prevent freezing of the casing. Only a small amount of water had entered the well while standing for test, but due to the presence of the column of oil with sufficient pressure to temporarily prevent entrance of possible water, a production test was requested upon completion of the well.

## SECTION 17.

Capitol Crude Oil Co.

Well No. 24, shut off. T 2-14.

This well was completed without approval of test of water shut-off from the department. To clear the records a production test from lead line was taken and test reported satisfactory.

T. 4 N., R. 22 W., S.B.B. &amp; M.

## SECTION 11.

Pan-American Petroleum Co.

Well No. 6, Vogel, commence drilling. P 2-1.

Records on file were not sufficient to determine in advance depth of water shut-off. Recommended that formations producing oil in adjoining wells be protected from water.

Well No. 6, Vogel, supplementary to drill. P 2-125.

Approved supplementary proposal to drill up and sidetrack 12½" casing collapsed near shoe and prospect ahead with the 10" casing.

## SECTION 12.

Santa Maria Crude Oil Co.

Well No. 3, shut off. T 2-11.

Water shut off. Test satisfactory.

## SECTION 14.

Pan-American Petroleum Co.

Well No. 36, deepen. P 2-10.

Approved method proposed for deepening.

Well No. 37, commence drilling. P 2-9.

Approved proposed depth of water shut-off.

Well No. 37, abandon. P 2-88.

Approved proposal to pull out all casing possible, and fill hole with mud, no plugging being necessary, on account of oil-bearing formations not having been penetrated.

## SECTION 15.

Pan-American Petroleum Co.

Well No. 1, Pinkerton, new well. P 2-52.

Wildcat well. Information not sufficient to indicate exact depth at which water should be shut off. Recommended cementing each string of casing landed above oil-bearing formations in order that such formations could be properly tested.

## VENTURA FIELD.

T. 3 N., R. 23 W., S.B.B. & M.

## SECTION 16.

Dabney and Lloyd.

Well No. 1, Traders, abandon. P 2-16.

In order to protect gas-bearing formations encountered in drilling, oil formations penetrated not having proven commercially productive, recommendation was made that mud laden fluid be pumped into the well under pressure and forced back into the gas sands and that the mud be left in contact with the sand in the bottom of the well. The proposal to thereafter remove all casing possible from the well was approved.

## SECTION 21.

Shell Company of California.

Well No. 1, Taylor, redrill. P 2-6.

The proposal to redrill the well in an attempt to produce the gas encountered in the bottom of the well was approved as satisfactory.

Well No. 1, Taylor, deepen. P 2-89.

The company entered a proposal to deepen the well through what was ostensibly the upper oil horizon with water not shut off. The proposal to deepen was approved with provision that in case oil-bearing formations were encountered during drilling operations, it would be necessary for the company to bridge above such showing and cement a water string for shut-off in order that such formations could be tested for productiveness.

Well No. 1, Taylor, supplementary to deepen. P 2-102.

The company then entered supplementary proposal to redrill the well at former shut-off point and endeavor to shut off water at approximately the same depth as formerly and attempt to produce the gas previously encountered. This proposal was approved.

Well No. 1, Taylor, shut off. T 2-70.

Test showed no water entering the well. Approval given to proceed with drilling.

Well No. 1, Gosnell, deepen. P 2-20.

A proposal to change the shut-off depth and deepen the well on account of absence of oil indications was approved.

Well No. 1, Gosnell, supplementary to deepen. P 2-31.

Having encountered a good showing of oil, the proposal to cement a water string above this showing was also approved.

Well No. 1, Gosnell, supplementary, recement. P 2-41.

Water not shut off with first cement job. Circulation established. Approved proposal to recement.

## Shell Co. of California—Continued.

Well No. 1, Gosnell, shut off. T 2-30.

A production test taken after cementing the 8½" casing showed no water.

Well No. 1, Gosnell, redrill. P 2-69.

A proposal to pull the liner from the bottom of the well and bail to let sand in was approved.

Well No. 1, Gosnell, deepen. P 2-86.

Proposal to deepen was approved with provision that if the amount of water shown by previous production did not diminish upon subsequent tests, it might become necessary to repair the well.

Well No. 1, Gosnell, supplementary to deepen. P 2-87.

Approved method outlined of testing out oil sand encountered.

Well No. 1, Gosnell, supplementary to deepen. P 2-95.

Following a conference of oil operators in this field, approval was given to carry the water string down through the oil sands encountered and previously tested, water not being shut off, and to mud and cement this casing above deeper oil sands, if such should be encountered, in order to test the deeper sands. It was agreed that this well should be considered a prospect well and that upon testing out the territory, the water would be shut off according to recommendations to be made by this bureau.

Well No. 1, Gosnell, supplementary to deepen. P 2-115.

Approved the further deepening of the well, oil formations to be mudded and cemented in an effort to protect them from water.

Well No. 1, Gosnell, supplementary to deepen. P 2-141.

Approved certain tests to determine productiveness of oil formations.

## SECTION 22.

## State Consolidated Oil Co.

Well No. 2, Lloyd, supplementary to redrill. P 2-80.

Supplementary proposal submitted with reference to depth of cementing the 12½" and 15½" casings in line with certain provisions contained in Departmental Order No. 4 in reference to this well, was approved.

Well No. 2, Lloyd, report of cementing. T 2-35.

The report gives a record of the cementing of the 12½" casing.

Well No. 2, Lloyd, suspension of Order No. 4. P 2-96.

Well making large amount of water and gas and some oil after drilling out bridge below 12½" casing. Approved proposal for temporary suspension of Departmental Order No. 4 in order to allow well to produce, awaiting further developments in this area.

Well No. 2, Lloyd, suspension of Order No. 4. P 2-112.

Approved further suspension of Departmental Order No. 4, contingent upon further developments. Well still producing.

Well No. 3, Lloyd, commence drilling. P 2-53.

Approved proposed depth of water shut-off. Requested drilling reports after a depth of 2200' had been reached.

Well No. 3, Lloyd, report of cementing. T 2-42.

The report gives a record of the cementing of the 10" casing.

Well No. 3, Lloyd, supplementary. P 2-132.

A proposal to pump this well for a certain period for a production test was approved.

## General Petroleum Corporation.

Well No. 1, Barnard, shut off. T 2-59.

Production test showed that the well was making considerable water and very little oil.

## Shell Company of California.

Well No. 1, Hartman, to plug. P 2-38.

Proposal to plug bottom of well approved.

Well No. 1, Hartman, redrill. P 2-133.

Proposal to redrill this well, shutting off water above first showing of oil, as logged, was approved as satisfactory.

## SECTION 23.

Shell Company of California.

Well No. 1, McGonigle, supplementary to drill. P 2-108.

A proposal of the company to waive bailing test in the 10" water string was approved and certain specifications made for the method of deepening the well in case oil-bearing formations should be encountered.

T. 3 N., R. 24 W., S.B.B. & M.

## SECTION 22.

General Petroleum Corporation.

Well No. 1, Hobson, supplementary to deepen. P 2-40.

Method of deepening with water not shut off was approved, as no oil-bearing formations were reported as having been encountered.

T. 4 N., R. 23 W., S.B.B. & M.

## SECTION 33.

New Mexico Oil Co.

Well No. 1, commence drilling. P 2-68.

As this well was a wildcat well, data not sufficient to indicate the depth at which water should be shut off. Recommended that the company keep an accurate log of formations penetrated and shut off water, if encountered, before penetrating oil-bearing formations.

Well No. 2, commence drilling. P 2-83.

No water having been encountered in Well No. 1 in this vicinity and oil having been encountered at a very shallow depth, the proposal to drill this well in a similar manner as Well No. 1 was approved.

Well No. 3, commence drilling. P 2-93.

Approved method of drilling this well as proposed.

Well No. 4, commence drilling. P 2-116.

Proposal to drill with open hole to shallow oil formations was approved, due to lack of water in other and adjoining wells.

Well No. 5, commence drilling. P 2-117.

Method of drilling into shallow oil horizon approved.

Well No. 6, commence drilling. P 2-118.

Proposal to drill this well as outlined, no water shut-off necessary for top oil horizon, was satisfactory.

Well No. 7, commence drilling. P 2-143.

Approved proposal to drill with open hole into shallow oil formations, providing no water was encountered.

H. L. Hays.

Well No. 1, commence drilling. P 2-144.

Wildcat well. No definite data available on which to base estimate for depth of water shut-off. Recommended that water be shut off above oil-bearing formations by bridging back above such formations, if encountered, and cementing a water string, in order that these formations might be properly tested. Requested drilling reports to be filed so that further recommendations could be made if necessary, but the company has failed to comply with this request.

## MISCELLANEOUS.

T. 2 N., R. 21 W., S.B.B. & M.

## LEWIS RANCHO.

St. Helens Petroleum Co., Ltd.

Well No. 1, Lewis, commence drilling. P 2-13.

The company could not intelligently estimate the depth at which water should be shut off as this was a wildcat well. Proposal to keep the department informed as to operations and shut off water above any oil formations encountered during drilling was satisfactory.

## LANNING RANCH.

St. Helens Petroleum Co., Ltd.

Well No. 1, Lanning, commence drilling, P 2-60. .

Conditions similar to Well No. 1, Lewis, of this company reported above. The proposal to keep this office informed in case oil or gas formations were encountered was approved.

## PERKINS RANCH.

Lot 46.

Joseph B. Dabney.

Well No. 1, commence drilling. P 2-17.

Data not sufficient to estimate depth of water shut-off. Recommended that each string of casing landed be cemented as a precautionary measure.

## CHAPTER V.

SANTA BARBARA, SAN LUIS OBISPO, MONTEREY AND  
SANTA CLARA COUNTIES

By H. W. BELL, Deputy Supervisor.

The bulk of the work of this department during the year closing June 30, 1918, has been centered about development operations in the Arroyo Grande, Casmalia, Cat Canyon and Santa Maria fields. With the exception of the Santa Maria field there were fewer wells reported for drilling this year than in the preceding year. In passing upon proposals to drill wells in developed areas in the Cat Canyon and Santa Maria fields, aside from completing certain peg models, only the usual routine engineering work was necessary, because studies of structural and subsurface conditions, in both these fields, had been practically completed at the end of the last fiscal year. The Casmalia field, however, continues to present new problems in structure and water conditions.

During the year additional peg models of portions of the Cat Canyon, Casmalia and Santa Maria field were completed. These models now cover 7200 acres of proved oil land. This is an increase of 4950 acres over completions at the end of the last year. About 80 per cent of the proved and active portion of the Santa Maria-Lompoc district is now covered by peg models.

There were 31 wells reported for abandonment during the year as compared with 44 wells in the year previous. Although this indicates an apparent decline in abandonment operations it does not tell the whole story. During the previous year there was much activity among wrecking companies, and some operators, in abandoning wells in order to get casing and other material to use in drilling new wells. Long before the close of the present fiscal year available old wells for this purpose had been reduced to a minimum. Most of the present year's abandonment operations represent the wind-up on wildcat wells, started within the last two years. At least four of the wells, representing an estimated expense of \$315,000, were drilled in areas in which structural and geological conditions were manifestly unfavorable and prospecting was unjustifiable from an engineering, hence, economic, point of view. In most cases, however, structural conditions and proximity to developed areas justified the expense.

At the time the Santa Maria office was opened and for a considerable period thereafter, not a single operating company in the district had an engineer in its employ for the special purpose of studying conditions with respect to indicating probable depths to shut off water and

encounter oil. The burden of all such engineering work fell upon this department. It is therefore gratifying to report that three of the larger companies now have resident engineers in their employ. This is not mentioned as though entailing a shifting of work or responsibility. It is already apparent that the exchange of ideas and information, as between these engineers and members of the department, has been reciprocally advantageous.

Acknowledgment is made to the operators of the district who, with few exceptions, through their co-operative attitude, have facilitated the carrying out of the work and instructions of this department. There have been no formal complaints by any operators against their neighbors. This does not mean, however, that repair of wells in several localities is not needed.

The deputy in charge was transferred from the Coalinga office to Santa Maria in September, 1917, and up to the end of May, 1918, acted in the capacity of petroleum engineer and inspector under former deputy, R. E. Collom. He was appointed to the position of deputy when Mr. Collom was transferred to the San Francisco office, as chief deputy, in June, 1918.

#### Summary of Well Records.

The number of wells in this district, new, drilled or abandoned, and other data as to logs and productions of oil and water, are shown in the following tabulation:

Field	Wells listed			Logs filed	Graphic logs	Number of wells accounted for by production reports	Number of wells actually producing, according to production reports	Average daily production		Average daily production per producing well		Per cent of water
	New	Wells drilled	Wells abandoned					Barrels oil	Barrels water	Barrels oil	Barrels water	
Santa Maria	9	227	44	251	206	219	215	8,765	4,089	41	19.0	31.8
Cat Canyon	5	65	38	90	55	40	36	2,604	161	72	4.5	5.8
Casmalia	36	64	12	78	65	65	64	6,182	1,785	97	11.0	22.4
Lompoc		37	18	45	24	28	27	1,273	1,304	47	48.6	50.6
Ios Alamos	2	2	6	8	1	1						
Arroyo Grande	5	14	3	5		15	12	202	20	17	1.7	9.0
Sargent	1	7	5	13		8	8	57	4	7	0.5	6.6
Summerland		138										
Miscellaneous	5	8	7	7								
Totals	63	562	133	500	354	376	362	19,083	7,364	52.7	20.3	28.0

The following table shows the totals of notices received and decisions rendered on proposed oil well operations in the various fields, during the past year, in District No. 3:

District No. 3 - Field	New wells		Test of water shut-off		Deepen or redrill		Abandon	
	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
Santa Maria	9	13	21	20	16	19	2	2
Cat Canyon	5	6	18	22	16	20	2	2
Casmalia	36	44	83	85	38	44	3	4
Lompoc			1	2	1	3	3	7
Arroyo Grande	5	6	10	8	5	6	3	3
Sargent	1	1		1	1	1	3	5
Los Alamos	2	2	6	4			3	6
Miscellaneous	5	6	1	1	2	2	6	8
Totals	63	78	140	143	79	95	31	43

### ARROYO GRANDE FIELD.

There were eight wells added to the producing list in the Arroyo Grande field during the last fiscal year. Wildcat operations in that field have not increased the proved area. The Tiber Pacific Oil Company and the California Oil Company are both operating producing wells in the only proved portion of the field.

The following table gives comparative figures for water and oil produced during June, 1917, and June, 1918:

	June, 1917	June, 1918	Increase
Total fluid	2,553	5,553	3,000
Water	75	573	498
Oil	2,478	4,980	2,502
Number of wells producing	4	11	7

### CASMALIA FIELD OPERATIONS.

During the fiscal year 1917-1918 this department received 36 notices to drill new wells in the Casmalia field. During the same period 47 new wells were added to the list of producers, and only five wells were abandoned. All of the wells which were abandoned were located on the outskirts of the field, and in "wildcat" areas. The several tables accompanying this report show the amounts of oil and water produced. There are several factors which render the drilling of wells, and remedial work for control of the water in this field, uncertain. They are:

- (1) The porous character of the hard oil-bearing brown shales;
- (2) Absence of sand strata and difficulty of correlating blue, gray and brown shales;
- (3) Difficulty of defining the location of the hot *bottom* water.

(4) The possible admittance of top water to the oil-bearing brown shales.

(5) The uncertainty of position and of the correlation of top waters. These several factors are discussed as follows:

(1) The hard brown shales are metamorphosed marine sediments, essentially chalcedony or flint in composition. They are usually composed of alternating layers of hard and soft shale, and the whole mass seems to be creviced and fractured. They constitute a very hard, yet porous, medium. The porosity is always considerable, but is found to be quite variable in different locations. Examples of this are given elsewhere in this report. It is known that oil, water, mud and cement have found easy passage through them.

The lateral travel of both top and bottom water through these brown shales has complicated the problem of securing proper protection to the oil deposits by remedial work.

(2) It is quite certain that the contour of the contact of the brown and blue (or gray) shales does not accurately delineate the stratigraphy. However, a study of a peg model has led to the conclusion that such correlation is a rational basis for making a further study of conditions. The accompanying contour map shows the top of the hard brown shale, the upper portion of which in the western part of the field is known as the tar zone.

In several wells the positions of the top of the hard brown shale, or its equivalent, are hard to determine. This is probably due, to some extent, to the different formational names applied by the various drillers. The underground structure of the field, as shown by the contour map, Fig. 13, which is based on the logs of wells, corresponds in a general way to that accorded to it by a study of the surface conditions alone. The main anticlinal axis has a northwesterly-southeasterly trend, but this appears to be supplemented by smaller anticlinal spurs, and by domes. The existence of at least one sharp fold is shown, along which it is possible that faulting has occurred. The theory has been tentatively advanced that block faulting is probably responsible in part for the irregularity of the contact of the shale members. Aside from the foregoing, it is probable that the hardening of the brown shale has taken place along zones that are not entirely parallel with the bedding planes, and that the reservoirs of oil and gas are defined by the lines of least resistance within these zones. Hence the porosity, and not necessarily the stratigraphy, has determined the migration of oil and gas. Wherever brown shales are found in this area, such coloration is due to petroliferous saturation, and it is probable that the porous portions of bodies of shale, once blue or gray, in contact with this zone, have been similarly colored.

(3) The hot bottom water is carried by hard brown shales, which are identical in character to those carrying the oil. With the exception of one well, any parting between the two fluids has never been definitely located. When drilling in the oil measures, water must be used to hold back, or "lubricate," the heavy oil, in order to allow the tools and bailer to work properly. Although a well may be drilled too deep, the presence of this bottom water is not evident, usually, until the well has produced continuously for several weeks or longer. The following is the apparent reason for this condition:

As the head of viscous oil is removed from a well that has been drilled too deep, and as the gas pressure diminishes, the less viscous water finds easy access to the pump, and the oil is thereby held in check from entering the well. This bottom water has been known to flow from the top of a well, but only after the well had produced oil for some time. For the elimination of bottom water in these wells, successful plugging operations are often difficult. The heavy oil works into the cement, and thickly coats the walls of the hole. The setting of the cement and its bond with the walls of the hole are therefore rendered uncertain.

(4) In the western portion of the field, the policy of cementing two water strings has been followed. The upper string was cemented for the purpose of excluding the top water from the tar zone. The lower string was cemented for the purpose of separating the cool, heavy oil of the tar zone from the hot, heavy oil of the oil zone, and as an additional protection to the oil zone, in case the top shut-off became ineffective, or in case the top water was let into the tar zone by some other well.

In the eastern portion of the field, conditions are somewhat different, inasmuch as the present productive measures appear to correlate with the above-mentioned tar zone. Therefore one water string has been the rule in that area.

In the west side of the field, several water strings have been carried as low as 400 feet into the tar zone without taking any precaution, with the exception of an inadequate amount of cement, to hold the top water above the porous brown shales of the tar zone. It is true that the most conspicuous cases of this condition are shown in the first wells drilled in this area. During the drilling of these wells practically nothing was known of the underground conditions. After water has been let into the tar zone, it can no doubt travel through the porous shales to other wells, and, if the second shut-off is not effective at a well, it will pass down the hole, or around the outside of the cement, and enter the oil zone below. It is known that cementing done in these shales, without the application of mud fluid, is liable to be a failure, on account of the cement running out laterally into the formations. In several wells water has been logged in the tar zone. However, it has not been conclusively proved by pumping test that primary water exists there.

(5) In drilling some of the first wells in the Casmalia field unexpected water was found below the top shut-offs. This demonstrated that the position and number of these top waters is erratic. It is probably responsible, in a measure, for some of the first wells having their second shut-offs too deep, the object being to make certain of getting below all top water. The result of this overreaching is discussed under No. 4.

The formations being generally favorable, the operators have adopted the plan of drilling the wells, down to the first considerable shows of oil, with as little drilling water as possible. Thus in most cases they are drilled "dry," using just enough water to properly mix the drillings. By this means the location of top water is easily determinable, except when a strong flow from one water-bearing formation is sufficient to fill the hole enough to void the possible evidence of a lower water. Some wells of late have been drilled to the productive zone and thoroughly tested before final shut-off point was decided. In other cases shallow shut-offs have been made, for prospecting purposes, either by cementing or by formation shut-off, below all probable top water. Then the wells have been drilled dry to the productive zone, after which the lower shut-offs have been effected on top of bridges.

In the eastern portion of the field, one water string has been the rule, but in some cases, as described above, the operator has considered it good policy to make two shut-offs. The following is an illustration of this idea: In a new well, drilled in this way, a temporary formation shut-off was made at 396' with 12½" casing, to exclude all probable top water. On the notice for drilling this well it was proposed, and this department approved the plan, to mud the formations between the 12½" and the 10" shoes, to cement the 10" casing, and to then remove the 12½" casing. A 20" hole was drilled and about 220 cu. ft. of mud was converted into mud-fluid and placed behind the 12½" casing at the surface. The mud-fluid did not fill up to the surface. Water logged at 310' was reported to have entered the hole at the rate of 50 bbl. per hour, and to have risen to a level of 240'. The 12½" casing successfully excluded the top water, and the well was then drilled dry to a depth of 850'. The deputy was called, and it was witnessed by bailing test that the formation between 396' and 850' carried no appreciable water. Drilling was continued under the same conditions to 1595', when it was again witnessed by the deputy that the formations encountered below 396' were dry. The casing was moved to more adequately demonstrate this point. Later the superintendent reported that the well had been drilled to a depth of 1873' into brown shale, with no water showing. The formations below 396' were then mudded, using about 50 cu. yds. of mud fluid, and the 10" casing was cemented in gray shale at 1845', using 150 sacks of hydraulic lime, followed by 200 sacks of cement.

When tested, the 10" shut-off was approved by this department. Instead of pulling 12½" casing as contemplated, the superintendent decided that it was good insurance to leave the casing undisturbed.

In addition to the advantage mentioned under No. 5, of drilling the wells dry, there is a distinct increase in rate of drilling over results obtained by "drilling wet." One Casmalia operator believes that the average total time of drilling his wells "dry" is only about one-half of the time consumed by the "wet" method. Another superintendent gives his idea of the average results as follows: Where a 1600' well could be drilled "wet" in 40 days, the "dry" method would reduce the time to 30 days, effecting a time saving of 25 per cent. In so far as the mere capacity of the bit to penetrate the formations is concerned, results indicate that "drilling dry" can accomplish, under ideal conditions, as much as eight times the amount of hole possible by the "wet" process. Some of the factors which tend to minimize the value of "dry" drilling are:

(1) Caving formation, which usually necessitates carrying casing near the drill, and underreaming for same. In the "wet" method, the hole is usually drilled for several hundred feet, in this way, with open hole, using a proper size bit to obviate the necessity for underreaming;

(2) Permanent or temporary shut-offs that might otherwise be omitted. The haphazard occurrence of the different top waters sometimes makes it more economical to finish the hole at least partially "wet," in order to avoid the expense of handling casing for any other shut-offs;

(3) Heavy oil entering the hole, and necessitating the use of water to hold it back, and to "lubricate" it for a sufficiently free action of the tools. Especially is this true on the west side of the field, where the oil is as heavy as 8° Baumé gravity.

On account of the above-mentioned conditions, each well is really an individual problem for the determination of the best procedure to accomplish the drilling (*i. e.*, "wet" or "dry").

During the past fiscal year the operators of the Casmalia field were urged by the Mining Bureau to experiment with mud-laden fluid in the drilling of wells with standard tools. The porous, fractured brown shales of this area are known to constitute a medium which permits of a considerable migration of fluid whenever opportunity offers. The idea was to fill the cavities with mud fluid, and thereby build up an impervious jacket around each well. With this accomplished, the result was figured to be the sealing of the strata, and the confinement of any oil and water bodies to their original positions, and also to have the effect of keeping the cement from traveling laterally into the shale during the operation of cementing a water string.

The production of the Casmalia field is obtained by three companies, the Associated Oil Co., Doheny-Pacific Petroleum Co., and the Union Oil Co. About the first of 1918 two of these companies began using mud-fluid in an effort to avoid serious water conditions. It is yet too early to gauge the results of these operations by production reports. At about twenty wells drilled with cable tools mud has been used in varying amounts and under varying conditions. The shales adjacent to the wells have taken from 10 to 240 cu. yds. of mud-laden fluid per well, indicating a great variation in porosity. In some cases the mud was put in under an extra pump pressure of several hundred pounds per square inch, while in others the mud was simply circulated, and more mud was added around the outside of the pipe at the surface, as the mud receded. It is reported that mud was thus added as many as five times, in an effort to maintain its level at the surface, but that the desired result was not obtained. The scarcity of good mud in the vicinity added to the difficulty of the operation. The best quality obtained was taken from old sump holes.

One operating company carrying out the mudding operations persistently was not satisfied until a permanent column of mud reached the surface, but in other cases the work was not properly done, and best results could not be expected. In a few cases mud has been placed behind both water strings. In these cases, in the western part of the field, the tar zone was mudded at the final operation.

As an illustration of the beneficial results from the use of mud at Casmalia, an outline of operations of well No. 14, Soladino, of the Doheny-Pacific Petroleum Company, is given as follows: A string of 12½" casing was cemented in blue shale at 1025' and a string of 10" casing was cemented at 1120', the shoe of the latter string being at the contact of blue shale above, and brown shale below. There had been only a small amount of water found below the shoe of the 12½" casing, and this water was apparently not active enough to show the condition of the 10" shut-off in its true light. This shut-off seemed to be successful. There had been used 100 sacks of cement, but returns of water did not reach the surface. It was noted that the water back of the casing came within 30' of the top. The well was drilled in and started producing, after which considerable water appeared. Bridging and testing proved that the water had broken in around the 10" shoe. A strain was put on this pipe, and it was easily removed from the well. When the casing was examined, it was found that only about four feet of cement showed above the shoe. The cement had evidently traveled laterally and downward into the porous brown shale. Being unable to loosen the 12½" casing, the formations below the 12½" shoe were thoroughly mudded under pressure, using 170 cu. yds. of mud-laden

fluid. The 10" was then cemented at 1168'. When pumping in the cement, mud-fluid was displaced and overflowed at the surface, indicating that the cement went up back of the pipe. Upon testing, the shut-off was approved.

The following cases illustrate the variation of the porosity of these brown shales:

(1) Mudding operations were about to be started on a well, but, due to the fact that the formations would take but very little water under a pump pressure of 300 lbs., the mud was not used.

(2) A new well was started with rotary outfit. It was found impracticable to maintain circulation, although a large quantity of chopped rope and other material calculated to retain the mud was introduced. At a depth of about 400' standard tools were substituted. The average condition of porosity of the hard brown shale, as noted by drilling operations, leans toward case No. 2, rather than toward case No. 1.

The following table gives comparative figures for water and oil produced during June, 1917, and June, 1918:

	June, 1917	June, 1918	Increase
Total fluid .....	67,433	371,184	303,751
Water .....	5,935	115,123	109,188
Oil .....	61,508	256,061	194,553
Number of producing wells.....	13	63	50

### Water Analyses.

The use of water analyses to indicate the source of oil well waters, has afforded considerable valuable evidence in connection with the Californian fields. The accompanying table of "Chemical analyses, (fig. 14), of oil-well water of Casmalia field" shows conclusively that they are also of economic value. The most reliable distinguishing chemical characteristics of the average samples of the "top" and "bottom" waters are as follows:

- (1) "Secondary alkalinity," which shows the amount of carbonate of calcium and magnesium to be greater in the top waters;
- (2) "Total dissolved solids," which is greater in the bottom water. This condition is usually true and is explainable by the fact that the deeper water has traveled a greater distance through formations, and therefore has had more opportunity to dissolve mineral matter therefrom. This idea assumes that the top water is of meteoric origin.
- (3) "Per cent of  $\text{rSO}_4$  in  $\text{rSO}_4 + \text{rCl}$ ," which is greater for the top water. The presence of mere sulphates and less chlorides in top water is a common phenomenon in the oilfield waters of California.

## CHEMICAL ANALYSES OF OIL-Well WATERS OF CASMALIA FIELD

Sample from Well No.	Depth of Sample	Top Water	Bottom Water	IONIC ANALYSES										SPECIAL PROPERTIES		RATIOS			
				PARTS PER MILLION OR MILLIGRAMS PER LITER		PER LITER								SALINITY		ALKALINITY		% SO <sub>4</sub> in SO <sub>4</sub> +Cl	Ratio of SO <sub>4</sub> to SO <sub>4</sub>
				TOTAL DISSOLVED SOLIDS	SiO <sub>2</sub>	CO <sub>2</sub>	SO <sub>4</sub>	Ca <sup>++</sup>	Mg <sup>++</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>--</sup>	CO <sub>3</sub> <sup>--</sup>	HCO <sub>3</sub> <sup>-</sup>	Prim.	Sec.	Prim.	Sec.		
A.O.Co. A-101	275	✓		2615.5	187.5	600	7158	82	18.4	4984	788	360	10124	4686	0	4742	572	1044	1078
A.O.Co. A-42	550	✓		8789.8	910	1100	28206	360	407	28742	1333	0	26840	6556	0	3044	400	330	1589
A.O.Co. P-42	240	✓		564.5	900	300	1303	90	48	1104	644	0	1256	6836	0	1874	1290	30.11	153
A.O.Co. M-4	155	✓		1902.2	394	500	3770	674	644	2140	2508	0	8392	4496	0	2064	3440	46.30	264
A.O.Co. P-137	250	✓		1852.7	506	400	4355	363	366	2424	521	0	9612	3342	0	4626	2032	13.60	1840
A.O.Co. M-25	330	✓		3433.4	860	300	9211	292	139	2710	336	430	20056	1960	0	7440	600	8.50	4910
A.O.Co. M-76	760	✓		7130.6	338	1009	20115	330	303	8737	158	300	40016	2730	0	6830	450	1730	20200
A.O.Co. M-34	310	✓		23372	110	900	5934	408	260	3000	1308	0	11456	3730	0	4880	1390	2430	690
A.O.Co. P-61	400	✓		9554.0	468	1100	30816	384	328	30660	84	0	31700	6250	0	3400	350	020	30500
D.P.P.Co. S-14	270	✓		4302.0	617	4362	10363	868	1051	10637	288	8211	0	5278	0	2486	2236	197	4540
D.P.P.Co. S-37	Near Top	✓		5399.8	165	7837	6978	856	847	4014	255	8891	0	2860	0	4460	2720	448	5580
D.P.P.Co. S-38	175	✓		4993.6	1702	19464	5675	1261	1666	7947	214	6532	0	5124	0	398	4478	203	4660
D.P.P.Co. S-38	280	✓		2633.0	487	670	3520	1788	1500	8650	99	3437	0	4810	2540	0	3280	089	5460
A.O.Co. Water Well		✓		324.5	Trace	580	487	189	95	880	274	236	0	5520	2440	0	1020	1895	139
A.O.Co. A-82		✓		1492.0	20	550	2974	774	1328	3860	305	4846	0	4180	0	500	5320	545	2561
Average				3821.6	623	2645	9390	581	611	8034	608	2216	10630						
A.O.Co. P-21	1835	✓		6218.4	0	5084	21578	860	204	26150	75	7798	0	7396	0	2004	600	022	16340
A.O.Co. A-91	Production		Probable	3615.0	356	1950	13080	291	217	13650	467	6174	0	6574	0	2888	538	250	2120
A.O.Co. A-91	?		Probable	4460.0	330	2620	15600	627	654	8995	1270	14504	0	3672	0	5214	1114	950	1820
A.O.Co. A-71	Production		Probable	5754.0	337	1200	17224	828	164	15120	302	0	22360	5380	0	3938	682	140	5790
D.P.P.Co. S-17	Production		Probable	7455.0	463	4500	27550	282	185	30220	229	11080	0	6986	0	2776	236	057	7540
D.P.P.Co. S-110	Production		Probable	10030.0	386	6910	30700	207	520	18030	466	26080	0	3734	0	5884	382	187	8950
D.P.P.Co. S-3	Production		Probable	4360.0	320	4410	15390	152	202	14200	214	8660	0	5934	0	3818	348	110	6520
D.P.P.Co. S-215	Production		Probable	13921.0	323	5520	52550	161	323	65460	168	14200	0	7962	0	1890	148	020	12700
D.P.P.Co. S-221	?		Probable	13595.0	222	8605	50200	120	226	65950	682	10020	0	8486	0	1403	111	075	2360
U.O.Co. E-2	Production		Probable	9043.0	397	7410	32600	176	159	42830	0	6930	0	8392	0	1456	152	0	88
A.O.Co. A-62	Production		Probable	6107.6	470	161	19266	221	173	14800	437	1048	24500	4940	0	4760	290	210	4300
Average				7687.2	319	4397	26885	257	275	28673	392	9681	4251						
A.O.Co. M-45	1605		Intermediate Surface Water	12559.0	480	3500	41575	5280	1212	52160	212	0	25820	7650	0	1720	650	030	9800
A.O.Co. P-61	1370		Intermediate Surface Water	15133.3	700	4609	43541	243	331	21059	1119	Trace	7954.5	3190	0	6600	200	370	5600
Average of Intermediate				13861.7	590	4054	42558	2761	771	36639	665	Trace	92582						

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Fig. 14.

The following is an explanation of the terms used in connection with the "special properties" shown in the table:

Primary salinity is a result of a combination of the alkalies, such as sodium and potassium, with the strong acids such as hydrochloric and sulphuric.

Secondary salinity is the result of a combination of the alkaline earths, such as calcium and magnesium, with the strong acids.

Primary alkalinity is the result of a combination of the alkalies with the weak acids, such as carbonic.

Secondary alkalinity is the result of a combination of the alkaline earths with the weak acids\*.

The Shell Company of California have employed water analyses to determine the presence or absence of new water during the drilling of their well in the Newhall tract. Frequent samples were taken at the bottom and near the top of the water column in the hole, and also of the drilling water that was added from the surface. This method demonstrated the presence and approximate location of new water zones, regardless of the fact that the hole was full of water. In one case a marked decrease in sulphates and increase in carbonates indicated the presence of a new body of water.

In "wildcat" operations, or in territory where the locations of water sands or zones are erratic, this method is especially worthy of consideration. A few analyses costing about a hundred dollars may be the means of saving a string of casing, costing several thousand dollars.

Thanks are due F. G. Tickell, resident engineer of the Associated Oil Company at Casmalia, who furnished the writer with considerable data used in the table of "Chemical analyses of oil-well water of Casmalia field."

#### CAT CANYON FIELD.

There has been no new development of interest in the Cat Canyon field during the past year. The Pan American Petroleum Investment Corporation, which conducted the principal development operations in the year previous, met with adverse water conditions and small production in the developed area on the Teresa Bell tract. Drilling of new wells in that area has been suspended. It is the writer's opinion, however, that the tract has not been prospected to the best advantage. History of early development, by other companies, along the northerly line of the Los Alamos Rancho, bounding this tract, indicates the possibility of the existence of productive formations in the anticlinal structure whose axis almost coincides and runs parallel with the northerly line of the Bell tract.

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\*For detailed information on this subject, see Bulletin No. 653, of the U. S. Geological Survey, and references mentioned therein.

In the Brooks-Stendell area in the Cat Canyon field the Brooks Oil Company and the Palmer Union Oil Company each brought in a new well. The peg model of this area indicates that the productive formations lie in an anticlinal spur, plunging northwesterly, off the north flank of the main anticline traversing the Solomon Hills.

The following gives comparative figures for water and oil produced during June, 1917, and June, 1918:

	June, 1917	June, 1918	Increase
Total fluid .....	74,250	30,855	16,586
Water .....	3,337	7,614	4,277
Oil .....	70,912	23,241	12,309
Number of wells producing.....	24	31	7

#### LOMPOC FIELD.

No new development has taken place in the Lompoc field. Nearly all of the proved area in this field is operated by the Union Oil Company, excepting one quarter section belonging to the Orcutt Oil Co. The Union Oil Company has producing wells extending over a strip of land, 3.6 miles in length, in the northerly end of the Purisima Rancho. The average distance between wells is 1700'. There is still room for a number of producing wells in this area. The field is not being properly protected from water. It is now producing more water than oil. The following table shows an increase of 6792 barrels of water as between June, 1917, and June, 1918, and a decrease of 2468 barrels of oil, with equal numbers of wells producing.

	June, 1917	June, 1918	Increase	Decrease
Total fluid .....	81,088	85,412	4,324	-----
Water .....	37,836	44,628	6,792	-----
Oil .....	43,252	40,784	-----	2,468
Number of wells producing.....	27	27	-----	-----

#### SANTA MARIA FIELD.

In the Santa Maria field the principal development of interest has taken place in the eastern portion of the field along the east-west line dividing the properties of the Union Oil Company and the Western Union Oil Company. In this area six new wells have been brought in with initial productions running as high as 1000 bbl. per day of 26 gravity oil. The production comes from the second oil zone. To date the oil is practically free from water. There has been some variance in the casing programs of the two operators drilling along this line. The question of properly protecting oil bearing formations from water under the respective programs has been the subject of two conferences

between representatives of these companies and this department. The principal question involved is that of the use of cement rather than formation shut-offs. It is the writer's opinion that cement shut-offs will insure greater durability to casing. The method of drilling in this area, whether by rotary or cable tools, is a matter of minor importance, in so far as shutting off water is involved, as there is a body of nearly a thousand feet of blue shale above the second oil zone in which to land casing.

Early in the past fiscal year the Union Oil Company acquired ownership of all holdings of Pinal Dome Oil Company in the Santa Maria District.

In the older part of the field, on the Newlove, California Coast, Hartnell, Harris and Graciosa leases, the Union Oil Company deepened a number of wells from the second to third oil zone with good effect. On the Harris lease the Union Oil Company drilled well No. 3 to get production from the third oil zone. This well had not been completed at the close of the fiscal year. Some interesting developments relative to water conditions were noted in this well. These features are given in detail in the Lists of Decisions of Santa Maria field. An intermediate water apparently exists between the second and third oil zones in the area along the Newlove-Graciosa (Harris) line. A number of the earlier wells drilled to the second oil zone in this area may have entered this intermediate water. This is mentioned as an additional clue to those given under discussion of water conditions in the First and Second Annual reports<sup>1</sup> with relation to the flooding of second oil zone production.

The following table gives comparative figures for water and oil produced during June, 1917, and June, 1918:

	June, 1917	June, 1918	Increase	Decrease
Total fluid .....	431,923	411,210		47,719
Water .....	163,205	135,501		24,704
Oil .....	301,724	278,709		23,015
Number of wells producing.....	196	208	12	

### SARGENT FIELD.

The Watsonville Oil Company has resumed control of operations in the Sargent field. The Sargent Ranch property was operated, during the year previous, by the Gilroy Oil Company.

<sup>1</sup>First Annual Report, Bull. 73, Cal. State Mining Bureau, Water Conditions Santa Maria Field, pages 198-202.

Second Annual Report, Bull. 82, Cal. State Mining Bureau, Water Conditions Santa Maria Field, pages 202-204.

The following table gives comparative figures for water and oil produced during June, 1917, and June, 1918:

	June, 1917	June, 1918	Increase	Decrease
Total fluid -----	1,770	1,700	-----	70
Water -----	120	100	-----	20
Oil -----	1,650	1,600	-----	50
Number of wells producing-----	6	8	2	-----

**REPORT ON SOLADINO-ARRELLANES GROUP OF WELLS.  
DOHENY-PACIFIC PETROLEUM COMPANY.  
ASSOCIATED OIL COMPANY.  
CASMALIA FIELD.**

By R. E. COLLOM, Deputy Supervisor, to R. F. McLAUGHLIN, State Oil and Gas Supervisor.

The following is an analysis of operations as to drilling, formations, protective work and productions in the Soladino-Arelllanes line wells, Casmalia field, owned respectively by the Doheny-Pacific Petroleum Company and the Associated Oil Company.

The wells included in the group are:

Doheny-Pacific wells:

Soladino Nos. 1, 2, 3, 4, 5, 6, 7, 8, and 9.

Associated wells:

Arrelllanes Nos. A-91 (old A-2; [P. O. T. No. 1]).

A-80 (old No. 4), A-81 (old No. 5), A-71 (old No. 6), A-61 (old No. 7).

The following table gives the initial drilling dates, dates of completion, total drilled depth, etc., of each of the wells in the group:

## SOLADINO-ARRELLANES LINE WELLS, JANUARY 1, 1918.

Well number	Drilling started	Drilling completed	Total depth	Castings		Cemented		Oil strings		Tubed to		Plugs	
				15½-in.	12½-in.	10-in.	8½-in.	Size	Amount	Size	Amount	From	To
Soladino, 1	10/ 3/16	2/ 7/17	1,865	C-200	C-1,121			10	1,384	4½	1,342		
Soladino, 2	10/ 9/16	12/28/16	1,565	C-200	C-1,215			10	1,538	4½	1,417		
Soladino, 3	10/12/16	2/14/17	1,860	C-200	C-1,141	C-1,430				4½	1,481	1,800	1,650
Soladino, 4	10/18/16	3/12/17	1,850	C-843	C-1,430					4½	1,482	1,850	1,650
Soladino, 5	10/27/16	2/ 3/17	1,720		C-500					4½	1,457		
Soladino, 6	2/ 4/17	5/16/17	1,633		C-745	C-1,358		8½	1,404	4	1,625		
Soladino, 7	1/25/17	9/12/17	1,790		C-805	C-1,383			1,536	4½	1,552		
Soladino, 8	2/ 2/17	12/22/17	1,925		C-1,100			10	1,800	3	1,773		
Soladino, 9	3/14/17	8/21/17	1,650		C-1,420	C-1,524				4	1,550		
Arrellanes, A-61	8/ 2/17	11/24/17	1,640		C-857	C-1,330				4½	1,360		
Arrellanes, A-71	3/10/17	6/ 8/17	1,632		C-825	C-1,410				4½	1,560		
Arrellanes, A-81	8/13/15	4/12/16	1,852		C-739	C-1,430				4½	1,300	1,852	1,740
Arrellanes, A-81	2/24/17	7/ 4/17	1,595		C-790	C-1,375		8½	1,500	4½	1,397		
Arrellanes, A-91	3/21/04	4/ 3/05	2,485			C-667	C-1,365			*8½		1,920	1,720

\*Cemented, not yet tubed.

C—cemented.

**Development.**

Well No. A-91 was the first well drilled in the group. The drilling was done by the Producers Oil and Transportation Company. The well was not put on production, after being drilled to a depth of 2485 feet, because the oil, logged as asphaltum, was not marketable in 1905.

The Casmalia Syndicate took over the Arrellanes property and well A-91 in 1915. A new well, No. A-80, was drilled and the old P. O. T. well, No. A-91, was redrilled. Well No. A-80 was completed April 12, 1916, at a depth of 1852', and showed an initial production of about 400 bbl. of 8.5 gravity. The well was not pumped for more than a few days at a time because there was no market. The production showed only a small amount of water during these intermittent productive periods. Continuous production at a later date gave radically different results.

In October, 1916, the Doheny-Pacific Petroleum Company started drilling Soladino wells Nos. 1, 2, 3, 4, and 5 along the Soladino-Arellanes line. These wells, see index map on cross-section attached hereto, are 300' apart and 150' from the line.

Drilling was completed on Soladino well No. 1 on February 7, 1917, at a depth of 1865'. The company's records state that from February 17 to February 28, 1917, the well averaged 500 bbl. daily of clean oil. On March 1, 1917, the well produced 1800 bbl. 10.5 gravity oil and on March 2 the production rose to 7000 bbl. and showed some water. On March 3 the production declined to 1600 bbl. fluid and on March 4 the production was 1600 bbl. fluid, showing about equal parts of oil and water. The well was then shut down for one day and the following is a record of the fluid production for March 6 to 31, inclusive:

Date	Bbl. fluid	Per cent water
March 6.....	1,000	Little water—no cut.
7.....	1,000	Little water—no cut.
8.....	900	Little water—no cut.
9.....	900	40 per cent.
10.....	900	40 per cent.
11.....	1,000	50 per cent.
12.....	1,100	60 per cent.
13.....	1,100	60 per cent.
14.....	1,100	60 per cent.
15.....	1,000	{ 11 per cent, a.m. test.
16 (Well shut down to March 26).		{ 25 per cent, p.m. test.
27.....	800	No water.
28.....	800	No cut—some water.
29 (Shut down).		
30 (Shut down).		
31.....	850	Into sump—no water.

It was thought at this time that the water was drilling water, as large quantities had been wasted into the formations in drilling this well.

However, the foregoing history of the initial productive period of Soladino well No. 1 is typical, as will be shown later, of that of the following other wells of the group:

Soladino wells Nos. 3, 4, 5 and 7, and  
Arrellanes well No. A-80,

and it has since been concluded that the water being produced is not drilling water.

#### **Drilling Conditions.**

As a basis for study of the conditions in this group the formations entered by the wells are divided into three zones, namely, Water Zone, Tar Zone and Oil Zone. These divisions and the respective zone thicknesses are shown on the cross-section attached hereto.

The paramount difficulty in the identification of formations entered by the drill in the Casmalia field lies in the fact that all formations are shale. Of course the shale is of varying degrees of hardness. There are places in which caves or "rotten shale" occur. When certain wells were being drilled with hole kept filled with drilling water, large quantities of water ran away into these formations. With the exception of the "Shell" at the top of the Oil Zone, which seems to be fairly persistent in this group, formations stratigraphically equivalent are hard to identify. When the Tar and Oil zones are entered the problem of proper formational designation becomes more complicated as both tar and oil, because of their heavy gravity, follow the drill and contaminate results. Under these conditions, granting the possibility of separate oil and water strata in the lowest formations thus far entered, the companies have found no practical way in which the drill, or bailing operations during drilling, can register the passing from oil formation to water formation, or the reverse.

Lately, as little drilling water as possible has been used in drilling operations. In fact the holes have been drilled practically dry, perhaps using one barrel of water in order to make mud of the cuttings. This method has been adopted in order to avoid the wasting of large quantities of drilling water into productive zones and also with the hope of being able to tell through the rise of fluid, if the drill enters a water stratum.

Recent operations in cementing a string of 12½" casing at 920' in well No. A-52<sup>1</sup> illustrate the difficulties attendant upon operations in these shale bodies.

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<sup>1</sup> Although this well is not in the group under consideration, it is in the next line of wells west of the Arrellanes wells being discussed. Cemented January 8, 1918.

This well was drilled dry. That is, while drilling with open hole, only enough water to mud cuttings was dumped in bottom with a bailer. When casing was started into the hole the necessary water was run in from surface. Careful watch was kept of operations. Apparently no water stratum was entered in drilling to the depth of 920'.

At 920' an attempt was made to cement a string of 12½" casing with 150 sacks by the Perkins process. The casing was full of water prior to the entry of cement. The water was displaced from the casing and also the cement fluid with very little pump pressure and without fluid returns outside the casing at the surface.

On the day following this operation 100 sacks of cement were pumped into the hole outside the 12½" casing through a string of 620' of 1" pipe. It was stated that returns showed continuously at the surface during this operation.

From the fact that there was no water found in drilling this well and that the hole was only 6' ahead of the shoe, when the well was tested for shut-off, one would naturally expect that, after the hole had been bailed dry and allowed to stand for 12 hours, no water would show in the hole. However, when the bailing test was made, the hole was found to contain 230 gallons of water. Subsequent tests showed decrease in the amount of water collecting in the hole, and it was concluded that the water came from shales adjacent to the shoe where it had been forced during cementing operations.

It is obvious from the foregoing that conditions in these shales call for something more than the usual cementing operations.

#### **Shut-offs.**

Stratigraphic uniformity in the matter of water shut-offs is a vital necessity in a proper protective program in this group. There was very little definite information available when the first five Soladino wells were drilled other than the casing program adopted, and in later operations consistently adhered to, by the Casmalia Syndicate in well No. A-80.

In this well a string of 12½" casing was cemented at a depth of 739' above the first "tar show" at the top of the now called Tar Zone, in order to exclude water above this depth. The well was then drilled through the Tar Zone. At a depth of 1420' the drill entered a hard shell and at 1440' entered a hot oil stratum at the top of the oil zone. Subsequent drilling has showed the foregoing to be the principal definite segregations. A basic correlation has therefore been made through the shells, logged at the top of the oil zone, in the various wells shown in the attached cross-section.

**Stratigraphic Datum.**

Parallel to this line of correlation at the top of the oil zone, a line has been drawn through derrick floor elevation, that is, zero depth from surface, at Soladino Well No. 1. This well, from peg-model evidence and the cross-section of the group, appears to be very close to the crest of the anticlinal structure. The line, so drawn, is called Stratigraphic Datum.

**Progress Chart.**

The progress chart, attached hereto, drawn with respect to depths and time, shows all depths, from initial drilling dates to completion, computed and plotted with respect to stratigraphic datum. On this chart, lines of correlation become horizontal lines and the status of any group of operations, as regards stratigraphic uniformity, for any given date, may be studied easily.

In order to get the actual depth below surface for any well on any date it is necessary to add the distance from derrick floor to stratigraphic datum. The necessary correction for each well is shown on the chart.

**Composite Graphic Log.**

At the left end of the chart is a composite graphic log of the wells in the group. All water-bearing formations logged in the group are shown. A number of the water strata, logged in various wells, are stratigraphically coincident in the composite log. It is obvious, because of the intimate relationship of the wells, that the knowledge or suspicion of any source of water in any well of the group should be considered in connection with the water problems of all other wells of the group.

**Original Program for Operations.**

At a meeting in the Santa Maria office of this department on the afternoon of March 28, 1917, at which the following representatives of operators in the Casmalia field were present:

Mr. W. Canfield, Associated Oil Company,

Mr. T. A. Collins, Doheny-Pacific Petroleum Company.

Mr. M. A. Kerr, Pinal Dome Oil Company (now U. O. Co.),

Mr. F. Marsh, Casmalia Syndicate (now A. O. Co.),

the following points were discussed relative to operations by the respective companies in the Casmalia field:

(1) Proper depth to carry top water string.

(2) Productive value of brown shales, lying between 750 and 1450 foot levels, on the Soladino-Arrellanes line.

(3) Probable origin of water in the tar zone, whether drilling water, of which the shales consume large quantities, or water stored in crevices in the shales.

(4) Should another string of casing be landed and cemented in the shell at 1450' before going into the oil zone proper.

It was considered to be of primary importance to cement a string of casing in the big shell, mentioned in item 4, or in some formation of a suitable nature stratigraphically equivalent thereto, in order to protect the oil zone.

There was believed to be a variation in the productive quality of the brown shale body, now called the tar zone, mentioned in item 2, and, in order to conserve any production in the tar zone a top-water shut-off should be made in suitable formation near the top of the tar zone.

In case, however, further drilling of wells demonstrated that there is a considerable area over which the tar zone is not productive, then, it was concluded, a string of casing could be carried to the big shell, mentioned in item 4, and cemented there, using *sufficient* cement to seal all formations through the tar zone so that there would be no possibility of top water being carried down below the stratigraphical points of shut off in other wells, and thus increasing the water content of the tar zone.

There is little variation from the foregoing in the problems that confront the operators at this time. There is the added problem of the appearance of large quantities of water in the production of certain wells, as already illustrated from the initial behavior of Soladino No. 1. The probable source of this water is discussed later.

A study of the progress chart for operations after April 1, 1917, will show to what extent the interested parties have followed the understanding as to proper protective measures developed in the conference of March 28, 1917.

#### Tests of Tar Zone.

In order to determine the productive value of the tar zone the Associated Oil Company suspended drilling at depths within this zone after, in each case, making an upper water shut-off in wells Nos. A-61 and A-71 and pumped them for test.

The following are the results of these tests:

Test in A-61—September 26-October 9, inclusive: See progress chart.

September 25: Depth of hole 1450', string of 12 cemented 857'.

September 26: Pumping for test, oil and emulsion.

Gravity, 8.1 Baume.

	Barrels oil	Barrels water
September 27.....	168	32
28.....	184	16
29.....	138	12
30.....	71	4
October 1.....	71	4
2.....	72	3
3.....	69	6
4.....	92	8
5.....	86	14
6.....	89	11
7.....	89	11
8.....	88	12
9 (Rods parted, oil coming in 1050' to 1100'. Hole caved at 1100'.)		
10 (End of test.)		

Test in A-71—April 24-May 1, inclusive; See progress chart.

April 27: Depth of hole 1411', string of 1½ cemented 825'.

	Barrels fluid per day	Barrels water
May 1.....	12	12
2.....	12	12
3.....	5	5
4.....	5	5
5.....	5	5
6.....	5	5
End of test.		

NOTE.—Drilling was suspended on A-81 at 1377', during the time of testing A-71.

It will be noted from the foregoing that well No. A-61 showed a considerable production from the tar zone. This production is very heavy, however, 8.1 deg. Baume, and, although it is advisable to conserve the oil, it undoubtedly should be segregated from the production of the oil zone which, if it were not for the fortunate advantage of coming hot from the ground (130 to 140° F.) would be difficult in itself to handle.

### Production.

The following is a summary of the average production per well per day, in oil and water, of the various wells in the group, to January 1, 1918:

#### SUMMARY OF MONTHLY PRODUCTION REPORTS.

##### Doheny-Pacific Company, Casmalia Field.

Year 1917	Soladino No. 1				Soladino No. 2				Soladino No. 3			
	Oil, barrels daily	Gravity	Water, barrels daily	Days pro- ducting	Oil, barrels daily	Gravity	Water, barrels daily	Days pro- ducting	Oil, barrels daily	Gravity	Water, barrels daily	Days pro- ducting
February .....	416	10.5	17	12	403	10.5	17	25	361	10.5	15	8
March .....	951	10.5	478	17	594	10.5	13	26	595	10.5	51	16
April .....	349	10.5	481	10	515	10.5	8	30	524	10.5	56	5
May .....	250	9.6	51	10	452	9.6	22	31	500	10.5	108	17
June .....	325	9.4	11	23	381	9.4	19	29				
July .....	206	9.4	48	28	259	9.4	36	20	228	9.4	67	14
August .....	208	9.4	57	28½	486	9.4	10	3½	166	9.4	48	22½
September .....	249	9.4	98	24½	437	9.4	22	24½	64.7	9.4	487	10½
October .....	286	9.7	66	30½	407	9.4	27	31	234	9	151	6½
November .....	277	9.2	74	29½	374	9.3	20	29½	219	9	91	13½
December .....	266	9.4	83	31	377	9.4	23	31	249	9.2	164	14½

Year 1917	Well No A-81			Well No. A-91		
	Oil barrels daily	Gravity	Days pro- ducing	Oil barrels daily	Gravity	Days pro- ducing
October	473		27	10		
November	491	8.6	9	12		
December	469	9.4	31	28	269	269

### Gravity of Oil.

Because much of the oil is heavier than water, in corrected gravity 8.2 to 9.8° Baume, there has been some speculation as to the probable relative positions of oil and water in these wells. It is known that in the sump holes it often happens that water will be on top of the oil. Considering the high temperature of the oil while in the wells, however, resulting in an increase in volume, and the fact that there is considerable gas mixed with the oil, there would seem to be little question but that the oil will rise to the top of any water in the wells.

### Sources of Water.

The source of the large quantities of water, shown on the production reports, has not yet been satisfactorily determined.

Some of the representatives of both companies are inclined to the opinion that most of the water, showing in production, comes from the water zone, that is, from known water strata above or in the tar zone.

If such is the case this water must enter the wells through:

(1) Faulty shut-offs.

(2) Carried down behind a water string into a fracture zone and thence working its way through crevices and fractures, around and below the shut-off, into the oil zone.

(3) Lack of uniformity in shut-offs. For example, water is carried to a much greater depth, with 12½" strings, in Soladino wells Nos. 1, 2 and 3 than in Soladino wells Nos. 4 and 5, or Arrellanes wells A-61, A-71, A-80, A-81.

The production record of Soladino well No. 2, however, does not indicate that any great amount of water has been so carried to the lower oil formations.

On the contrary, it lends support, along with the following evidence, to the probability that the large quantities of water are coming from the bottom of the oil zone.

Soladino Well No. 2 is one of the shallowest wells in the group. It has always been a comparatively clean producer.

Soladino Well No. 1, as has already been shown, and reference to the foregoing production reports will give later details, produced large quantities of water during portions of March and April, 1917.

On April 18, 1917, the work of bridging this hole, for the purpose of cementing a string of 10" casing, stratigraphically uniform with other shut-offs near the shell at the top of the oil zone, was started. On May 1, 1917, this hole had been bridged to 1556'. The 10" casing has not been cemented to date, although it is the company's intention, at this writing, to plug the well in bottom and cement the 10" casing, later.

The well was again put on pump in May, 1917, and the subsequent record is for production of fluid supposedly taken from above the bridge.

It will be noted that since the well was bridged the water production has greatly decreased. It therefore would appear that much of the water produced in March and April, 1917, came from a depth greater than 1556 feet (top of the bridge). It is possible that some, if not all, of the water now coming into the well, has its source in the water zone, back of the 12½" casing. There is also the possibility that part of the production, showing in the well, comes from below the bridge, if the bridge is not secure, and that the bridge exerts sufficient back pressure to control the fluid below a depth of 1535' and hold back most of the water which usually appears when any of the deeper wells are produced unrestrainedly for a considerable length of time. There appears to be a condition in which the oil immediately available to a hole from its surrounding reservoir breaks in.

The following portion of a production record of Soladino Well No. 7 is typical of the behavior of the wells that produce large quantities of water:

	Bbl. oil	Bbl. water
October 18 .....	369	40
October 19 .....	240	60
October 20 .....	90	10
October 21 .....	50	"
October 22 .....	336	14
October 23 .....	160	240

\*Started flowing water. Shut down.

Although there are no data, as to dates at hand, it is known that Arrellanes Well No. A-80 suddenly turned to large water production the first time it was pumped for a number of days and that after the well was shut down and pumping again resumed it produced clean oil for a time.

In each of the cases of this kind the water produced was hot. Temperature readings made at lead-line in Soladino Wells No. 3 and 4, under similar behavior, showed 142 and 138 deg. Fahrenheit, respectively.

#### Analyses of Water.

Chemical analyses have been made of a number of samples of the hot water. Samples of water taken from shallow depths, in the water zone have also been analyzed, although none of the later type have been taken from wells in the line-group.

The following are the results of some of these analyses in grains per U. S. gallon:

Well number	Hot Water.						
	Depth (feet)	Total solids	Sodium carbonate	Sodium chloride	Sodium sulfate	Magnesium carbonate	Calcium carbonate
Soladino No. 3.....		254.40	82.10	136.83	1.53	3.91	none
Soladino No. 4.....		220.00	76.00	141.00	2.10	none	4.25
Arrellanes A-91.....		211.48	54.09	131.56	3.56	4.14	none

Water Zone.							
Soladino No. 14.....	270	250.86	44.61	102.25	2.48	21.25	none
Soladino No. 38.....	175	281.12	5.58	76.41	1.85	33.67	none
Soladino No. 37.....	180	314.80	57.04	38.59	2.21	17.13	none

\*Incomplete.

A close resemblance will be noted in the contents of the three "Hot Water" samples, also in the contents of the three "Water Zone" samples. Casual inspection indicates that they are two different types of water. This is especially noticeable in the difference in the magnesium and calcium carbonate content of the two types. It remains, however, for the chemist to determine whether or not waters of the type from the "Water Zone," moving down through the tar and oil formations, would be transformed chemically into the "Hot Water" type with the possible evolution of the rather extraordinary amount of heat. Such a transformation would be necessary, in order to satisfy the theory that the large quantities of hot water are supplied from the strata in the water zone.

### Plugs.

A study of the progress chart, attached hereto, will show that a number of the wells, namely, Soladino No. 3, Soladino No. 4, Arrellanes A-80, and Arrellanes A-91 have been plugged in bottom with the hope of excluding the large quantities of hot water.

That these plugging operations have not instantly benefited these particular wells can be explained by a study of the character of the oil zone. The shales are fractured or creviced. (As an illustration, mud, used to establish circulation in Soladino No. 5, when the well was bridged to cement a string of 10", appeared in adjoining wells.) If water is present in large quantities in the lower part of the oil zone, then, as long as the bottom of any well lies open to this water the production of all the deeper wells of the group will continue to be affected.

### Remedial Work.

Therefore in order to systematically eliminate the possible water sources the following program should be followed:

- (1) All wells in the group should be plugged to a uniform stratigraphic position. The present production in Soladino No. 1 is probably coming from above 1535 feet and in Soladino No. 2 from above 1565 feet, and this is an indicator as to proper plugging depth.
- (2) A stratigraphically uniform shut-off should be made in all wells at the bottom of the tar zone.
- (3) Steps should be taken to remedy the discrepancies in uniformity of shut-off at the top of the tar zone.

Operations under the first two items have already been recommended, for various wells, by this department.

### Mud Seal.

It is the deputy's opinion that in future work in the group attempts should be made to build mud, by pumping mud laden fluid under pressure, into the creviced, fractured, cavy and rotten shales, which take large quantities of water and undoubtedly become channels for percolation and the migration of waters, from their native formations, at random through the area.

The Doheny-Pacific Petroleum Company is using hydraulic lime to a large extent in present cementing operations. No hydraulic lime was used in any of the wells of the group under discussion. The hydraulic lime fluid is pumped ahead of the cement fluid. It goes into the well and back of the casing under very little pump pressure. Usually, during the placing of the lime and cement fluid, complete water returns are gotten at the top of the casing. Under such conditions the best that can be said for the lime is that, when it sets, it will make a veneer on the walls of the hole and possibly assist in producing a bond with formation for the cement which follows it.

Without applied pressure very little lime or cement will find its way into the crevices and fractures, unless, of course, as in the case of A-52, already mentioned, circulation with returns can not be established. And, in that case, the fact that water was returned, on testing, from formations near the shoe shows that the sealing effect of cement, wasted into formations while cementing, was practically negligible.

The crevices and fractures should be filled, and rendered impervious, prior to cementing. The mudding operation should be immediately followed by the cementing operation, an excess of cement fluid being used, so that the first of the cement fluid will displace the mud between the casing and the wall of the hole. In the mudding operation it might

be necessary to use sawdust or some other material with the mud, to assist in establishing a clog or filter for the accumulation of the clay in the porous formations.

### Index of Operations.

The following is an index to the various reports which have been issued by this department with reference to operations in the Soladino-Arrellanes line wells, to January 1, 1918:

Report No.	Date	Proposal	Conclusion
Soladino No. 1 -		Shut-off	
B-30 .....	Oct. 31, 1916	Shut-off	Passed
B-41 .....	Dec. 14, 1916	Bridge	Passed
BB-63 .....	April 13, 1917	Cement 10 inches	Approved
Soladino No. 2 -		Shut-off	
B-31 .....	Oct. 31, 1916	Shut-off	Passed
B-40 .....	Dec. 14, 1916		Passed
Soladino No. 3 -		Shut-off	
B-32 .....	Oct. 31, 1916	Shut-off	Passed
B-43 .....	Dec. 14, 1916	Bridge	Passed
BB-87 .....	May 31, 1917	Cement 10 inches	Approved
		Plug bottom	
P 3-37 .....	Oct. 6, 1917	Pumping test	Approved
P 3-75 .....	Dec. 7, 1917		Not passed
Soladino No. 4 -		Shut-off	
B-39 .....	Dec. 14, 1916	Bridge and cement 12½ inches	Passed
BB-86 .....	May 31, 1917	Plug bottom	Approved
P 3-17 .....	Aug. 24, 1917	Pumping test	Approved
P 3-76 .....	Dec. 1, 1917		Not conclusive
Soladino No. 5 -		Shut-off	
B-42 .....	Dec. 14, 1916	Bridge and cement 10 inches	Passed
BB-88 .....	May 31, 1917	Pumping test	Approved
P 3-78 .....	Dec. 8, 1917		Recommended plug bottom
Soladino No. 6 -		Shut-off	
B-69 .....	Mar. 17, 1917	Shut-off	Not passed
B-88 .....	April 27, 1917		Passed
Soladino No. 7 -		Shut-off	
B-69 .....	Mar. 1, 1917	(Drill ahead for pumping test)	Passed
BB-66 .....	April 21, 1917	Pumping test	
P 3-79 .....	Dec. 8, 1917		Recommended bridge and test shut-off. Also plug bottom
Soladino No. 8 -		Shut-off	
T 3-25 .....	Aug. 31, 1917	Pumping test	Not passed
P 3-81 .....	Dec. 8, 1917		Recommended shut-off at top of oil zone
Soladino No. 9 -		Shut-off	
T 3-16 .....	Aug. 16, 1917		Passed
Arrellanes A-61 -		Shut-off	
T 3-29 .....	Sept. 10, 1917		Passed
Arrellanes A-71 -		Shut-off	
B-79 .....	April 12, 1917	Shut-off	Passed
B-95 .....	May 31, 1917	Plug bottom	Passed
Arrellanes A-80 -			Approved
P 3-59 .....	Nov. 12, 1917		
Arrellanes A-91 -			
(Old P. O. T. No. 1)		Redrill	
BB-41 .....	Oct. 23, 1916	Cement 10 inches	Approved
		Shut-off	
B-49 .....	Jan. 6, 1917	Cement 8½ inches	Passed
B-95 .....	June 29, 1917	Plug bottom	Approved

## DECISIONS.\*

## CAT CANYON FIELD.

T. 9 N., R. 32 W., S.B.B. &amp; M.

## SECTION 30.

Palmer Union Oil Co.

Well No. 2, Stendell, alter casing. P 3-30.

Proposal to cut off  $6\frac{1}{4}$ " oil string at 2600', approved.

Well No. 3, Stendell, abandon. P 3-58.

Following procedure recommended:

(1) Put cement plug inside of  $6\frac{1}{4}$ " casing between depths of 2590' and 2645', to seal perforations.(2) Cut off  $6\frac{1}{4}$ ", one joint above bottom of  $8\frac{1}{4}$ ", 2120', or as near that depth as it is practicable to cut, and put cement plug in the  $8\frac{1}{4}$ ", on top of  $6\frac{1}{4}$ " cut-off.

(3) Put cement plug on top of all other strings of casing that are cut off for removal.

Well No. 4, Stendell, shut off. T 3-31.

Shut-off satisfactory.

Union Oil Co. of California.

Well No. 3, Fleisher, shut off. T 3-73.

Shut-off satisfactory.

United Western Consolidated Oil Co.

Well No. 3, drill.

Proposed depth of shut-off approved.

## SECTION 31.

Associated Oil Co.

Well No. 4, plug. P 3-147.

Company's proposal to plug this well by stages, in order to eliminate water and be able to test for production, approved.

Brooks Oil Co.

Well No. 2, abandon. P 3-71.

Supplementary proposal to cancel notice of intention to abandon and remove 10' casing above 1100', and make further trial of the well for oil production, approved.

Well No. 3, drill. Report P 3-99.

Proposed depth of shut-off, 2300', approved.

Well No. 3, shut off. T 3-105.

Shut-off satisfactory.

Union Oil Co. of California.

Well No. 1, Santa Maria Enterprise, shut off. T 3-47.

Shut off approved, with the understanding that drilling will not proceed deeper than 2000' until statement of results of production test between present depth of 1652' and 2000' is filed with this department.

Well No. 1, Santa Maria Enterprise, redrill and cement. P 3-85.

Proposal to cement string of  $6\frac{1}{4}$ " casing at 2010' approved.

Well No. 1, Santa Maria Enterprise, shut off. T 3-81.

Shut-off satisfactory.

T. 9 N., R. 33 W., S.B.B. &amp; M.

## SECTION 23.

Santa Maria Oil Fields, Inc.

Well No. A-1, redrill. P 3-60.

Proposal to redrill approved on the following conditions:

(1) Run casing tester in  $8\frac{1}{4}$ " casing to test for leaks.(2) If  $8\frac{1}{4}$ " casing does not leak, build bridge at depth of 2500' and make test

\*Where no report number is given Decision made on Form No. 113.

for water shut-off of 8½". If it appears that the water is effectually shut off with the 8½" casing, it will not be necessary to redrill with 6½", as proposed.

(3) If water is not shut off with 8½" casing, redrill with 6½" casing and land and cement near bottom of blue shale body logged between depths of 2400 and 3038'.

(4) If, as in 3, the 6½" casing should be cemented, notify deputy for test of water shut-off.

Well No. A-1, shut off. T 3-113.

Shut-off satisfactory.

Well No. 2, alter casing. P 3-52.

Proposed to shoot pocket for cement and put in a string of 6½" casing and cement same. Proposal approved with recommendation that 6½" casing be cemented near bottom of blue clay logged between depths of 2600 and 3016'.

Well No. 2, redrill. P 3-65.

Proposal to drill down and land 4½" oil string, and make pumping test to determine efficacy of water shut-off, approved.

Well No. 3, redrill. P 3-7.

Proposal to redrill with 6½" casing to top of oil sand, cement off water, and then drill through oil sand with 4½" casing, finishing with 4½" liner, approved, with recommendation that the 6½" casing be cemented at a depth of at least 10' greater than 8½" was cemented, owing to the fact that the 8½" was apparently cemented below the top of the producing oil sand.

Well No. 3, redrill. P 3-43.

Proposal to cement 6½" at 2985', account of encountering oil sand at 2990', approved.

Well No. 3, redrill. P 3-61.

Proposal to drill down and land 4½" oil string, and make pumping test to determine efficacy of water shut-off, approved.

Well No. 8, shut off. T 3-17.

Shut-off satisfactory.

## SECTION 26.

Palmer Union Oil Co.

Well No. 5-A, abandon. P 3-10.

Proposal to abandon approved.

Palmer Union Oil Co.

Well No. 5-A, test plug. P 3-18.

Bridge and cement plug found satisfactory.

Well No. 5 shut off. T 3-78.

Shut-off satisfactory.

Well No. 5, shut off. T 3-106.

Relative to shut-off with 12½" casing, covered in report T 3-78, it later developed that there was a leak in the casing and it became necessary to make shut-off with 8½" casing. Test for water shut-off satisfactory.

Well No. 5, drill. P 3-173.

Supplementary proposal to sidetrack 8½" casing and cement 10" at about 2600', approved.

Well No. 5, redrill. P 3-186.

Proposal to plug hole and move derrick 24' and drill another hole with same designation, approved, with the recommendation that a neat cement plug be placed in contact with formations from 1204' to 1184', and that 12½" be plugged from 1184' up to 1169'.

Well No. 6, drill. P 3-142.

Proposed depth of shut-off approved.

Union Oil Co.

Well No. 3, Blochman, redrill. P 3-165.

Proposal to redrill from bottom of 10" approved, with the recommendation that care be taken not to disturb the 10" water string.

## Union Oil Co.—Continued.

Well No. 9, Blochman, drill. P 3-4.

Supplementary notice requesting recommendation as to point of landing 8 $\frac{1}{4}$ ". Recommended that the string of 8 $\frac{1}{4}$ " casing be cemented at a depth of 2915', to make shut-off stratigraphically uniform with 8 $\frac{1}{4}$ " shut-offs in Pinal Dome wells 7 and 8, Blochman Lease, and about 40' lower than the shut-off of the Santa Maria Oilfields, Inc., in Well No. B-1 (Section 27).

Well No. 9, Blochman, shut off. T 3-35.

Shut-off satisfactory.

## SECTION 27.

## Santa Maria Oil Fields, Inc.

Well No. B-1, abandon. P 3-15.

Proposal to abandon approved.

T. 10 N., R. 33 W., S.B.B. & M.

## SECTION 35.

## Fugler Ranch Oil Company.

Well No. 1, abandon. P 3-9.

Proposal to pull pipe and abandon well, approved, subject to recommendations outlined in the report.

Well No. 1, abandon. P 3-103.

Supplementary proposal relative to removal of casing and placing of cement plugs, approved.

Well No. 1, abandon. P 3-157.

Work of abandonment of this well completed by M. A. Kerr, in accordance with the requirements of this department.

## SHAW RANCH.

## Standard Oil Co.

Well No. 1, shut off. T 3-84.

Shut-off satisfactory.

T. 9 N., R. 33 W., S.B.B. & M.

## LAS FLORES LAND AND OIL CO.

## Union Oil Co.

Well No. 1, abandon. P 3-179.

Proposal to abandon approved.

Well No. 2, abandon. P 3-66.

Proposal to abandon approved.

## BELL RANCH.

## Pan-American Petroleum Investment Corporation.

Well No. 1, deepen. P 3-49.

Proposal to deepen approved, with the proviso that the well be drilled to a depth not greater than 3150'.

Well No. 4, shut off. T 3-41.

Shut-off approved.

Well No. 6-A, cement casing. P 3-62.

Proposal to cement string of 8 $\frac{5}{8}$ " casing at 2695', in order to shut off water entering at depth of 2618', approved.

Well No. 8-A "Temporary," shut off. T 3-13.

Shut-off approved.

Well No. 13-A "Temporary," shut off. T 3-11.

Shut-off approved. Recommended that in future in drilling out preparatory to shut-off test, wells be drilled to a depth not to exceed 10' below shoe, preferable 5', where data as to length of casing and sand line measurements check, in order to avoid complications in making the test.

Well No. 14-A "Temporary," shut off. T 3-24.

Shut-off approved.

## Pan-American Petroleum Investment Corporation—Continued.

Well No. 14-A "Temporary," shut off. T 3-53.

Shut-off not successful. Water apparently coming in either from leak in casing or below bridge. Well passed for productivity test.

Well No. 14-A "Temporary," cement casing. P 3-63.

Proposal to cement 8 $\frac{1}{2}$ " casing at 3490', in order to shut off water logged at 3094' and 3278', approved.

Well No. 14-A "Temporary," cement and deepen. P 3-135.

Proposal to cement 8 $\frac{1}{2}$ " casing at 3490' in order to test formations below that depth, approved.

Well No. 14-A "Temporary," shut off. T 3-121.

Shut-off satisfactory.

Well No. 15-A "Temporary," cement and deepen. P 3-136.

Proposal to cement 6 $\frac{1}{2}$ " 26-lb. casing at depth of 3600' in order to test formations below for oil, approved, with the understanding that every effort be made to seal the strata between depths of 3600' and 2744', in order to prevent migration of fluid from oil and water showings logged at that depth.

Well No. 15-A "Temporary," shut off. T 3-107.

Shut-off satisfactory.

## LOS ALAMOS RO.

## Union Oil Company of California.

Well No. 8, Bell, shut off. T 3-14.

Shut-off satisfactory.

Well No. 9, Bell, shut off. T 3-39.

Shut-off approved.

## LOS ALAMOS FIELD.

T. 7 N., R. 31 W., S.B.B. & M.

## SECTION 1.

## Standard Oil Co.

Well No. 1, Laguna, shut off. T 3-5.

Shut-off satisfactory.

Well No. 1, Laguna, abandon. P 3-53.

Proposal to abandon approved.

Well No. 1, Laguna, abandon, supplementary. P 3-143.

Supplementary proposal to abandon approved.

T. 8 N., R. 31 W., S.B.B. & M.

## LA LAGUNA RANCHO.

## Standard Oil Co.

Well No. 1, Fithian, shut off. T 3-33.

Shut-off satisfactory.

Well No. 1, Fithian, abandon. P 3-152.

Proposal to abandon approved.

T. 8 N., R. 32 W., S.B.B. & M.

## PEZZONI RANCH.

## Associated Oil Co.

Well No. 1, Pezzoni, shut off. T 3-76.

Test for water shut-off satisfactory.

## CORRAL DE QUATI.

## Associated Oil Co.

Well No. 1, shut off. T 3-88.

Shut-off satisfactory.

## T. 9 N., R. 32 W., S.B.B. &amp; M.

## LAGUNA RANCHO.

Union Oil Company of California.

Well No. T-2, abandon. P 3-12.

Proposal to abandon approved.

Well No. W-1, abandon. P 3-11.

Proposal to abandon approved.

Well No. W-1, abandon, supplementary. P 3-47.

Supplementary proposal to abandon approved.

## LOMPOC FIELD.

## T. 6 N., R. 31 W., S.B.B. &amp; M.

## SECTION 16.

Interstate Oil Co.

Well No. 3, redrill. P 3-32.

Proposal to redrill approved. This well was formerly the property of the Santa Barbara Oil Co., Ltd.

Well No. 3, redrill, supplementary. P 3-112.

Proposal to drill out bridge and make pumping test to determine source of water and productivity of formations below depth of 3380', approved.

Well No. 3, abandon. P 3-129.

Proposal to abandon approved, with the following recommendations: Bridge hole at 3450' and fill solidly with neat cement to a depth of 3365', being 15' above the shoe of the 4½" casing at 3380'; after bridge has set, shoot and pull 4½" casing; also remove 6½", 8¼" and 10" casings.

Well No. 3, abandon. P 3-130.

Proposal to bridge at 3396' and put in plug from 3396' to 3355', in 4½" casing, approved.

Well No. 3, abandon. P 3-155.

Proposal to alter position of plug from 1232' to 1195', in view of the determined position of the 12½" shoe, approved.

Well No. 3, shut off. T 3-109.

Shut-off satisfactory, and well passed for further process of abandonment.

## T. 7 N., R. 33 W., S.B.B. &amp; M.

## SECTION 9.

Lompoc Oil Developing Co.

Well No. 1, redrill. P 3-68.

Proposal to pull 4½" casing and cement another string of 4½" in order to test for production, approved.

Well No. 1, alter casing and plug in. P 3-102.

Proposal to plug hole at bottom and between 2398' and 2003', and cement 5½" at 1840' to test out sand, approved.

Well No. 2, abandon. P 3-28.

Approval of proposal to abandon withheld, pending receipt of further information in regard to the condition of the well.

Well No. 2, abandon. P 3-31.

In view of additional information received in regard to the condition of the well, permission given to remove 3" casing.

Well No. 2, abandon. P 3-33.

Recommended that all available casing be removed and that a cement plug be placed in the well, to be determined by the work of removing the casing, at about 1000', to exclude possible surface waters.

Well No. 2, abandon. P 3-83.

Work of abandonment, based on information filed with the department, approved.

## ARROYO GRANDE FIELD.

T. 31 S., R. 13 E., M.D.B. &amp; M.

## SECTION 31.

## California Oil Co.

Well No. 2, McNee, redrill. P 3-13.

Proposal to redrill approved.

Well No. 2, McNee, shut off. T 3-34.

Shut-off satisfactory.

Well No. 3, McNee, redrill. P 3-131.

Proposal to redrill approved.

Well No. 3, McNee, redrill, supplementary. P 3-170.

Supplementary proposal to cement a string of 8½" casing inside of 10" casing, in order to make production test, approved.

Well No. 6, Ltd., Shut off. T 3-77.

Shut-off satisfactory.

## Tiber Pacific Oil Co.

Well No. 6, redrill. P 3-29.

Proposal to redrill approved.

Well No. 6, deepen. P 3-118.

Proposal to prospect ahead approved, with the understanding that water conditions be watched.

Well No. 7, shut off. T 3-45.

Shut-off satisfactory.

Well No. 8, shut off. T 3-89.

Shut-off satisfactory.

Well No. 9, drill. P 3-84.

Proposed depth of shut-off approved.

Well No. 9, shut off. T 3-92.

Shut-off satisfactory.

Well No. 10, drill. P 3-133.

Proposed casing program approved.

Well No. 10, drill, supplementary. P 3-203.

Supplementary proposal to drill to productive zone before making a shut-off by cementing the oil string, approved.

## SECTION 36.

## Louis Titus Oil Co.

Well No. 1, shut off. T 3-8.

Shut-off approved upon statement of superintendent.

T. 32 S., R. 13 E., M.D.B. &amp; M.

## SECTION 6.

## Louis Titus Oil Co.

Well No. 1, McNee, abandon. P 3-88.

Proposal to abandon account of poor showing of oil and crooked hole, approved.

Well No. 1, McNee, abandon, supplementary. P 3-90.

Supplementary proposal to abandon rejected for the reason that it did not provide for effectively excluding water from coming into the hole from a depth of 1862'. The following recommendations made:

(1) That the well be cleaned out to a depth of 1320' and plugged with cement from 1320' to 1250'.

(2) That we be notified upon completion of this plugging operation so that depth to plug can be measured.

(3) That the well be bridged, and plugged with cement between depths of 832' and 792'.

(4) That this department be notified for test to depth recommended of cement plug inside of the 12½" casing at a depth of 792'.

**Louis Titus Oil Co.—Continued.**

Well No. 1, McNee, shut off. T 3-67.

Test was made to determine the depth suitable to cement plug that was started in the shoe of the water string and extended upward to a point above the same. It was concluded that the top plug required by P 3-88 and P 3-90 had been successfully placed, and the well was passed for the final work of abandonment.

**SECTION 18.**

**Highway Oil Co.**

Well No. 1, cement casing. P 3-72.

Proposal to cement string of 6½" at 2465', in order to test for production below this depth, approved.

Well No. 1, shut off. T 3-60.

Shut-off satisfactory.

Well No. 1, abandon. P 3-181.

Proposal to abandon approved. Notice to abandon was later canceled.

**MISCELLANEOUS.**

**Moody Gulch.**

T. 9 S., R. 1 W., M.D.B. & M.

**SECTION 8.**

**Rhoads & Schmitt.**

Well No. 1, drill. P 3-151.

Proposal to drill approved.

**Livermore Field.**

T. 3 S., R. 3 E., M.D.B. & M.

**SECTION 15.**

**W. M. & S. Oil Co.**

Well No. 1, abandon. P 3-178.

Proposal to abandon approved, with the understanding that a signed log of the well is forthcoming.

Well No. 1, abandon, supplementary. P 3-182.

Proposal to remove 11½" casing approved.

**BRADLEY FIELD.**

T. 24 S., R. 10 E., M.D.B. & M.

**SECTION 35.**

**Metropolis Oil Co.**

Well No. 1, abandon. P 3-141.

Wrecking company enjoined from doing proposed work by owners of land.

**SECTION 36.**

**Associated Oil Co.**

Well No. 1, King, deepen. P 3-24.

Proposal to drill ahead with 8½" casing in prospect for oil, approved.

Well No. 1, King, abandon. P 3-54.

Proposal to abandon approved.

**R. K. Howk.**

Well No. 1, Pleyto Cons. Oil Co., abandon. P 3-38.

Proposal to abandon approved, under conditions outlined.

Well No. 1, Pleyto Cons. Oil Co., abandon. P 3-82.

Abandonment operations approved.

**SARGENT FIELD.**

T. 11 S., R. 4 E., M.D.B. &amp; M.

**SECTION 31.**

Watsonville Oil Co.

Well No. 6, redrill. P 3-187.

Proposal to plug well in formations with cement between the depths of 1757' and 1800', approved.

Well No. 7, abandon. P 3-172.

Supplementary proposal to abandon approved.

Well No. 7, abandon. P 3-188.

Report of abandonment operations approved.

Well No. 9, abandon. P 3-8.

Proposal to abandon approved.

Well No. 10, abandon. P 3-1.

Proposal to abandon approved.

Well No. 12, abandon. P 3-34.

Proposal to abandon approved.

Well No. 13, drill.

Proposed depth of water shut-off approved.

Well No. 13, shut off. T 3-126.

Shut-off satisfactory.

**PARKFIELD DISTRICT.**

T. 23 N., R. 14 W., S.B.B. &amp; M.

**SECTION 15.**

Southern Pacific Co.

Well No. 1, drill. P 3-139.

Proposed depth of water shut-off approved.

**HUASNA FIELD.**

T. 11 N., R. 32 W., S.B.B. &amp; M.

**NIPOMO RANCH.**

Associated Oil Co.

Well No. 1, Stow, shut off. T 3-108.

Shut-off not satisfactory. Approval withheld awaiting further test. Casing cemented in serpentine.

Well No. 1, Stow, deepen. P 3-166.

Proposal to deepen without further water shut-off approved.

Well No. 1, Stow, abandon. P 3-180.

Proposal to abandon approved.

T. 12 N., R. 33 W., S.B.B. &amp; M.

**SECTION 25.**

Todd-Peck Syndicate.

Well No. 1, Clarion Oil Co., deepen. P 3-27.

Proposal to deepen approved.

Well No. 1, Clarion Oil Co., abandon. P 3-164.

Proposal to abandon approved.

**SANTA MARIA FIELD.**

T. 9 N., R. 33 W., S.B.B. &amp; M.

**SECTION 19.**

New Pennsylvania Petroleum Company.

Well No. 4, alter casing. P 3-64.

Proposal to remove 4½" casing approved.

## New Pennsylvania Petroleum Co.—Continued.

Well No. 4, alter casing. P 3-98.

- Proposal to cut and remove 6½" casing and perforate 8¼" casing, approved, with the understanding that water conditions be properly taken care of.

## Rice Ranch Oil Co.

Well No. 14, drill, supplementary. P 3-14.

Witnessed bailing test proving that there was no water back of the 10" casing to depth of cementing, 2460'.

## SECTION 22.

## Union Oil Co. of California.

Well No. 3, Los Flores, deepen. P 3-50.

Recommendation withheld pending test of shut-off of 8¼" casing.

Well No. 3, Los Flores, deepen. P 3-80.

Recommendation withheld pending further information as to source of water present under 8¼" casing.

Well No. 3, Los Flores, deepen. P 3-86.

Proposal to deepen approved.

T. 9 N., R. 34 W., S.B.B. & M.

## SECTION 22.

## Union Oil Co. of California.

Well No. 4, Hartnell, abandon. P 3-35.

Proposal to abandon approved.

## SECTION 23.

## Radium Oil Co.

Well No. 1, abandon. P 3-221.

Proposal to abandon approved, with recommendation that 40' cement plug be placed one-half in formations and one-half in 12½" casing, between depths of 675' and 635'.

## SECTION 26.

## Union Oil Co. of California.

Well No. 8, Squires, deepen. P 3-77.

Proposal to deepen approved.

Well No. 8, Squires, deepen. P 3-89.

Proposal to make pumping test to determine condition of 6¼" shut-off, approved.

Well No. 8, Squires, shut off. T 3-65.

Shut-off satisfactory.

Well No. 14, Squires, deepen. P 3-158.

Proposal to deepen approved, with the understanding that a string of casing will be cemented just above the top of the third oil zone, and that sufficient cement will be forced behind this casing to effectively seal the formations of the second oil zone, up to a depth of 3070'.

Well No. 4, California Coast, shut off. T 3-4.

Shut-off satisfactory.

Well No. 7, California Coast, deepen. P 3-40.

Proposal to deepen approved, with the understanding that a sufficient quantity of cement be placed back of the 6¼" casing to seal the oil bodies of the second zone so as to protect them from infiltrating water.

Well No. 8, California Coast, deepen. P 3-184.

Proposal to deepen approved.

## LOS ALAMOS RO.

## Union Oil Co. of California.

Well No. 1, Graciosa, deepen. P 3-96.

Proposal to waive bailing test and subject the well to pumping test, approved.

Well No. 1, Graciosa, shut off. T 3-66.

Shut-off, determined by pumping test, approved.

Well No. 5, Graciosa, shut off. T 3-20.

Shut-off satisfactory.

## Union Oil Co.—Continued.

Well No. 6, Graciosa, deepen. P 3-39.

Proposal to deepen approved, with the recommendation that a sufficient quantity of cement be placed back of the 6½" casing to seal the oil bodies of the second zone so as to protect them from infiltrating water.

Well No. 6, Graciosa, shut off. T 3-96.

Shut-off satisfactory.

Well No. 7, Graciosa, deepen. P 3-199.

Proposal to deepen approved, with the recommendation that care be taken to determine the character of formations encountered and to obviate the possibility of cementing above water-bearing strata, as in the vicinity of Harris No. 3.

Well No. 8, Graciosa, shut off. T 3-21.

Shut-off not successful. Recommended one of following procedures:

(1) Put in a string of 4½" and cement at a depth below the present 6½" landing at 3296', or

(2) Redrill and cement a string of 6½" below present depth of 6½", landing at 3296'.

Well No. 15, Graciosa, deepen. P 3-26.

Proposal to cement a string of 6½" casing at 3800', approved, with the understanding that sufficient cement be used to thoroughly seal all second zone formations from a depth of 2682' (landing point of 8½" casing) to the bottom of 6½" casing.

Well No. 1, Harris, deepen. P 3-21.

Proposal to deepen approved.

Well No. 2, Harris, deepen. P 3-20.

Proposal to deepen approved.

Well No. 3, Harris, shut off. T 3-22.

Shut-off approved.

Well No. 3, Harris, shut off. T 3-90.

Most of the cement, used for shut-off, was left inside the casing. Well passed for pumping test.

Well No. 3, Harris, drill, supplementary. P 3-138.

Pumping test, as recommended in Report T 3-90, showed that the well produced 10 barrels of oil and 10 barrels of water per day. The company proposed to put in a string of 6½" casing, and cement at the top of the third oil zone. Proposal to cement string of 6½" casing was approved with the recommendation that the shut-off be made at a depth of about 3750'. The company stated that they believed that the recommended depth of shut-off was too deep. The company's attention was called to the fact that average distance from the top of the second oil zone to the top of the third oil zone is 550' to 600' in this locality. It was noted that in deepening to the third zone the usual procedure, with some exceptions to be mentioned hereafter, has been to cement a string of casing at the top of the third oil zone. It was also noted that in Harris Well No. 3, the 8½" casing was cemented at 3457', or 247' below the top of the second oil zone.

It was pointed out that in wells Nos. 6 and 17, Newlove, and No. 14 Graciosa, shut-offs, for the purpose of excluding second zone oil and water, had been made at depths considerably shallower than the shut-offs in most of the wells of the group. Study of the production data of the sixteen third zone wells of the group, showed that the three wells mentioned were wet wells. It was noted that in each of the three wells mentioned, a shut-off was made because of the good oil showing in sand supposedly at the top of the third oil zone proper. There were sufficient data to show that the sand thus included in the third zone production of Newlove wells Nos. 6 and 17 and Graciosa Well No. 14, does not correlate with the producing sand in most of the third zone wells of the group. The top of said sand lies about 200' above the top of the third oil zone proper. It was, therefore, concluded that water appearing in third zone wells of the group, was coming from one of the following sources:

(1) Shut-offs not successful in Newlove 6, 17 and Graciosa 14. Newlove 6 showed successful shut-off in pumping test (see Report B-84, April 19, 1917). The

other wells showed successful tests for shut-off and this source was thought to be least probable.

(2) That the intermediate or "stray" oil sand, between the second and third oil zones, above which shut-offs are made in the three wet wells, carries water.

(3) That the third zone sand in these wells, being the farthest down the dip, carries edge-water.

This department therefore suggested that the company drill to a depth not greater stratigraphically than that at which the intermediate or stray sand is found in wells Nos. 6 and 17 Newlove (3600' to 3650'), or to such depth, above 3650', at which formations would stand up, and put the well on the pump at that depth. It was also stated that if such production test, provided the well were deep enough to engage the stray sand, showed the well to be making no more water, that is, 10 barrels per day, than it did immediately below the 8½" shut-off, this department would consider it unnecessary to cement another string of casing, providing the hole was finished in such condition, as to liner and other mechanical operations, that another string could be cemented in case the well later developed water, and test showed such a course to be necessary.

Well No. 3, Harris, drill, supplementary. P 3-144.

Company proposed to continue drilling to a probable depth of 3650', or as near that as conditions as a whole would permit, and make another pumping test and report results. The proposal was approved.

Well No. 3, Harris, drill, supplementary, by letter. P 3-154.

On March 28th the following letter was received from Mr. E. C. Critchlow, division superintendent of the Union Oil Co.:

"Referring to our conversation in your office yesterday relative to condition of our Harris No. 3, and confirming what we agreed upon at that time have to say that the well with a pumping test covering one week showed a production of approximately 200 barrels per day with a water content of from 40 to 50 per cent. As this well was only drilled into what you term a 'stray sand' we propose now to continue drilling operations until we pass through this sand, and then put the well to producing with the idea of knowing definitely how much oil and its character this sand contains. If, after sufficient test, it is not deemed advisable to produce from this sand we will bridge at the top of it and again, by a pumping test, find out if we still have the same amount of water and oil between the bridge and the bottom of our 8½" pipe. We will then be in a position to definitely determine whether this sand should be produced from or whether we should put a string of 6½" through it and cement it off."

The operations proposed in the letter were approved as follows:

(1) Continue drilling until the hole passes through sand entered at about 3630'.  
(2) After passing through sand put the well on pump and test for productivity as to oil and water.

(3) Report results of such test to this department.

(4) After the results of above mentioned test are at hand, further recommendations, covering the program of testing in this well, as outlined in the above quoted proposal, will be made.

On May 8, 1918, a representative of this department visited the well, and found that it was drilled to a total depth of 3731'. The company at that time was bridging back above the sand entered at a depth of 3630', in order to determine whether or not there had been an increase of water above the 10 barrels per day originally produced just below the 8½" shut-off. On June 25, 1918, Mr. Critchlow, division superintendent, stated to Deputy Supervisor Bell that after making exhaustive pumping tests, he was satisfied that the so-called "stray sand" contained water, and they would have to cement off below it.

Western Union Oil Co.

Well No. 47, redrill and plug. P 3-36.

Proposal to plug bottom of well into 6½" casing with cement, cut 6½" casing, and try well for production, approved.

## Western Union Oil Co.—Continued.

Well No. 52, deepen. P 3-42.

Proposal to deepen approved.

Well No. 58, drill, supplementary. P 3-44.

Proposal approved.

Well No. 58, deepen. P 3-100.

Proposal to prospect for production, with the plan of shutting off water at 4400' to 4450', with a string of 6½" casing, should production be found, approved.

Well No. 62, shut off. T 3-36.

Shut-off satisfactory.

Well No. 62, shut off. T 3-74.

Shut-off satisfactory.

Well No. 63, drill. P 3-160.

Proposal to drill approved.

Well No. 63, shut off. T 3-112.

Shut-off satisfactory.

Well No. 64, drill. P 3-156.

Proposed depth of cementing casing, approved.

Well No. 64, shut off. T 3-118.

Shut-off satisfactory.

Well No. 65, drill. P 3-183.

Proposal to drill approved, with the exception of the depth for cementing 10" casing, approval of which is withheld, awaiting log of proposed well.

Well No. 65, shut off. T 3-128.

Shut-off satisfactory.

Well No. 66, drill. P 3-191.

Proposal to drill approved, with the exception of the depth for cementing 10" casing, approval of which is withheld awaiting log of proposed well.

## NEWLOVE LEASE.

## Union Oil Co. of California.

Well No. 9, Newlove, deepen. P 3-3.

Proposal to deepen approved, with the recommendation that a string of 6½" casing be landed and cemented at a depth of 3360', using sufficient cement to seal to second zone formations between depths of 2795' and 3360'.

Well No. 11, Newlove, deepen. P 3-2.

Proposal to deepen approved, with the recommendation that a string of 6½" casing be landed and cemented at a depth of about 3185', using sufficient cement to seal all second zone formations between depths of 2679' and 3185'.

Well No. 11, Newlove, shut off. T 3-43.

Shut-off satisfactory.

Well No. 33, Newlove, shut off. T 3-23.

Shut-off satisfactory.

Well No. 45, Newlove, shut off. P 3-51.

Shut-off satisfactory.

Well No. 46, Newlove, drill. P 3-161.

Proposal to drill approved, with the understanding that a formation shut-off is to be made with 12½" casing in order to protect from top waters shallower than 500', as in Western Union No. 61, at 215', Western Union No. 62, at 95', and Western Union No. 60 at 270', and that careful tests be made while drilling to determine the presence or absence of such top waters, the results of which would indicate the advisability of cementing the 10" string.

## CASMALIA FIELD.

T. 9 N., R. 34 W., S.B.B. &amp; M.

PUNTA DE LA LAGUNA RO.

Associated Oil Co.

Well No. 34, Arellanes, drill. P 3-122.

Proposed depths of shut-off approved.

Well No. 42, Arellanes, drill.

Proposed depths of cementing 12½" and 10" casings approved. Proposal to land 8½" at 1900' rejected until company show reasonableness of drilling to such depth in face of water conditions in adjoining wells.

Well No. 42, Arellanes, shut off. T 3-116.

Test of shut-off satisfactory.

Well No. 52, Arellanes, drill.

Proposed depths of cementing 12½" and 10" casings approved. Proposal to land 8½" casing at 1850' rejected until company show reasonableness of drilling to such depth in face of water conditions in adjoining wells.

Well No. 52, Arellanes, shut off. T 3-85.

Tests Nos. 1 and 2 showed fluid entering hole. 12½" was cemented at 920'. Following several tests for water shut-off 100 sacks of cement were run in outside of casing through 620' of 1" pipe. Subsequent test for water shut-off satisfactory.

Well No. 52, Arellanes, shut off. T 3-98.

Test of shut-off satisfactory.

Well No. 53, Arellanes, drill. P 3-123.

Proposed casing program approved.

Well No. 61, Arellanes, shut off. T 3-29.

Test of shut-off satisfactory.

Well No. 61, Arellanes, pumping test. P 3-108.

Proposal to make pumping test approved.

Well No. 61, Arellanes, shut off. T 3-79.

Pumping test satisfactory.

Well No. 62, Arellanes, drill.

Proposed depths of cementing 12½" and 10" casings approved. The proposal to land 8½" at 1850' rejected as the well would probably enter bottom water.

Well No. 62, Arellanes, shut off. T 3-52.

Test of shut-off satisfactory.

Well No. 62, Arellanes shut off. T 3-91.

Test of shut-off satisfactory.

Well No. 62, Arellanes, plug. P 3-176.

Proposal to plug well in bottom to eliminate water approved.

Well No. 63, Arellanes, drill. P 3-124.

Proposed casing program approved.

Well No. 71, Arellanes, mud. P 3-149.

Proposal to pump mud from surface outside of 12½" casing to depth of approximately 500', in an effort to shut out possible surface water, approved.

Well No. 72, Arellanes, drill.

Proposed depth of cementing 12½" and 10" casings approved. Proposal to land 8½" casing at 1825' rejected account of possibility of entering hot water stratum before reaching this depth.

Well No. 72, Arellanes, shut off. T 3-46.

Test of water shut-off satisfactory.

Well No. 72, Arellanes, shut off. T 3-61.

Test of water shut-off satisfactory.

Well No. 80, Arellanes, plug. P 3-59.

Proposal to plug in bottom, to eliminate production of hot water approved.

Well No. 80, Arellanes, plug. P 3-150.

Proposal to place additional plug to eliminate water approved.

## Associated Oil Co.—Continued.

Well No. 81, Arellanes, shut off. T 3-1.

Test of water shut-off satisfactory.

Well No. 82, Arellanes, drill.

Proposed depth of cementing 12½" and 10" casings approved. Proposal to land 8¼" casing at 1800' rejected account possibility of entering hot water stratum near that depth.

Well No. 82, Arellanes, shut off. T 3-64.

Test of water shut-off satisfactory.

Well No. 82, Arellanes, shut off. T 3-86.

Test of water shut-off satisfactory.

Well No. 91, Arellanes, plug. P 3-148.

Proposal to plug from 1720' to 1660' to exclude hot water production approved.

Well No. 92, Arellanes, drill.

Proposed depth of cementing 12½" and 10" casings approved. Proposal to land 8¼" casing at 1800' rejected account possibility of entering hot water stratum before reaching this depth.

Well No. 101, Arellanes, shut off. T 3-71.

Test for water shut-off satisfactory.

Well No. 101, Arellanes, shut off. T 3-110.

Test for water shut-off satisfactory.

## Doheny Pacific Petroleum Co.

Well No. 1, Soladino, plug. P 3-107.

Hole was bridged from 1555' to 1419' and water production decreased from 481 bbls. per day before bridging to 50 bbls. per day after bridging. In view of above performance of the well, which indicated water in formations somewhere below 1419', the proposal to plug bottom of hole with cement to a depth of 1750' was approved.

Well No. 1, Soladino, plug. P 3-145.

After plugging operation approved in report No. P 3-107 the well still showed considerable water and proposal to place additional plug to a depth of 1700' was approved.

Well No. 3, Soladino, plug. P 3-37.

Proposal to plug from 1862' to 1650' to exclude bottom water approved.

Well No. 3, Soladino, pumping test. P 3-75.

Although results of pumping test, subsequent to plugging approved in report P 3-75 indicated a considerable decrease in water produced, as compared with production prior to plugging, approval of plugging operations was withheld awaiting the results of plugging operations in adjacent and neighboring wells.

Well No. 4, Soladino, plug. P 3-17.

Proposal to plug from 1850' to 1650' to exclude bottom water approved.

Well No. 4, Soladino, pumping test. P 3-76.

A comparison of data on pumping tests made before and after plugging as per report No. P 3-37 shows that prior to plugging the well averaged 65 bbls. oil and 295 bbls. water per day for a period of 15 days. After plugging, the well averaged 265 bbls. oil and 125 bbls. water per day.

It was concluded from the foregoing that plugging in bottom had materially improved the condition of the well. However, approval of plugging operations was withheld awaiting results of plugging in adjacent and neighboring wells and further results of pumping Soladino No. 4.

Well No. 5, Soladino, pumping test. P 3-78.

During the first fifteen days of pumping the production increased in emulsion and finally changed into flowing hot water. It was concluded that water was coming into the well from formations below the 10" shut-off.

Considering the fact that Soladino wells No. 3 and No. 4 were each plugged in bottom to a depth of 1650' and that Soladino No. 2 produced 420 bbls. oil and 25 bbls. water per day from a total drilled depth of 1565', stratigraphically much

less than any other Soladino wells, it was recommended that Soladino No. 5 be plugged in bottom to a depth of 1670' and subjected to further production tests. Well No. 5, Soladino, plug. P 3-146.

Proposal to plug, in accordance with recommendation in report No. P 3-78, approved.

Well No. 7, Soladino, pumping test. P 3-79.

On account of intermittent production large quantities of water recommended plug to 1700'.

Well No. 7, Soladino, plug. P 3-137.

Study of cross sections prepared by A. D. Fyfe, geologist for the company, showed that No. 7 was not as deep stratigraphically as first information led us to suppose. Recommendations of Report No. P 3-79, as to plugging, therefore canceled.

Well No. 8, Soladino, shut off. T 3-25.

12½" 40-lb., originally cemented at 1803', collapsed at 1440' upon bailing. Another string was cemented at 1100'. Tests for water shut-off not conclusive. Recommended drilling ahead below 1440', original point of collapse, and test further for water.

Well No. 8, Soladino, pumping test. P 3-81.

Proposal to make pumping test was filed at the request of the deputy so that the company's daily reports for production of oil and water could be written into the records. Recommendations as to pumping test are covered in report T 3-59.

Well No. 8, Soladino, shut off. T 3-59.

Pumping test for water shut-off satisfactory. Recommended second shut-off at 1600'.

Well No. 8, Soladino, plug and test. P 3-116.

Proposal to bridge hole to 1600' and test for water approved.

Well No. 9, Soladino, shut off. T 3-16.

Test for water shut-off satisfactory.

Well No. 9, Soladino, redrill. P 3-153.

Proposal to make dye test to determine source of water approved. Recommended that, in redrilling, a string of 12½" casing be cemented at 830' in order to be stratigraphically uniform with shut-off in Soladino No. 6.

Well No. 10, Soladino, shut off. T 3-27.

Test for water shut-off satisfactory.

Well No. 10, Soladino, deepen. P 3-41.

Proposal to deepen approved with proviso that well is not to be drilled to a depth greater than 1750'.

Well No. 11, Soladino, shut off. T 3-40.

Test for water shut-off satisfactory.

Well No. 12, Soladino, shut off. T 3-94.

Test for shut-off inconclusive. Recommended drilling ahead to first definite oil showing and making pumping test to determine whether there was an increase in small amount of water showing in test.

Well No. 14, Soladino, cement. P 3-101.

Proposal stated that well was making small amount of water. Proposed to cement another string of casing just above oil encountered at 1142'.

After reviewing data it was concluded that the cementing of another string of casing for the exclusion of 3 bbl. of water per day would hardly seem necessary. Therefore, recommended that the well be bailed dry and allowed to stand for 24 hours in order to determine exact rate of entry of water into the hole.

Well No. 14, Soladino, cement. P 3-106.

Acting upon our recommendation in report No. P 3-106 (see above) hole was bridged at 1120'. Hole was bailed dry and after standing 72 hours bailer was run and showed 316' of water in the hole. Proposal to cement 10" casing was approved.

Doheny-Pacific Petroleum Co.—Continued.

Well No. 14, Soladino, shut off. T 3-87.

Test for water shut-off 10" casing approved. See reports P 3-101 and P 3-106 above.

Well No. 14, Soladino, drill, supplementary. P 3-167.

Proposal to mud formations and recement either the 12½" casing or 10" casing in this well was approved because of the following conditions reported by Mr. T. A. Collins, superintendent:

"After drilling this well into production to a total drilled depth of 1800', we put well on pump for production test. We found very little oil and one bailer of water every six hours. Placed plug 20' under 10" pipe and found water had broken in around shoe of 10" casing. We put a strain on 10" casing and with little trouble pulled it loose. When 10" casing came loose the well showed increase of three bailers of water per hour."

The 10" casing was originally cemented with 100 sacks cement by the Perkins process and, because of the ease with which the casing was later removed, as reported by Mr. Collins, it is concluded that the cement fluid was pumped into the fractured shale formations immediately adjacent to the shoe of the 10" casing.

The company's proposal to mud the hole, prior to cementing, was made with the idea of sealing these fractured shale formations so that the cement fluid column could later be confined to the space between the wall of the hole and the casing. Well No. 14, Soladino, shut off. T 3-124.

This test was witnessed for the purpose of determining probable efficiency of mudding operations proposed and covered in preceding report No. P 3-167.

It was reported that about 170 cu. yds. of mud fluid had been forced into the formations adjacent to the 12½" and 10" shoes, that is between depths of 1025' and 1120', under a closed pressure of about 600 lbs. maximum and during a period of about 20 days. Manure was also used to assist in clogging the porous strata. At the time of inspection heavy mud fluid was being pumped down the 10" casing and returned to the surface between the 10" and 12½" casings. The open pressure developed was 200 lbs.

It was concluded that the mudding had been done in an efficient and workmanlike manner and that the desired end, the building of an impervious deposit around the hole had probably been accomplished.

Well No. 36, Soladino, drill. P 3-104.

Proposed casing program approved.

Well No. 36, Soladino, shut off. T 3-72.

Test for water shut-off satisfactory.

Well No. 37, Soladino, drill. P 3-105.

Proposed casing program approved.

Well No. 37, Soladino, shut off. T 3-75.

Test for water shut-off satisfactory.

Well No. 38, Soladino, shut off. T 3-63.

Test for water shut-off satisfactory.

Well No. 39, Soladino, shut off. T 3-7.

Test for water shut-off satisfactory.

Well No. 40, Soladino, shut off. T 3-57.

Pumping test for water shut off satisfactory.

Well No. 41, Soladino, shut off. T 3-15.

Test for water shut-off satisfactory.

Well No. 41, Soladino, redrill. P 3-193.

Company proposed to mud formations between depths of 1142' and 1674' in order to protect said formations from surface water and, further, in order to temporarily exclude water from formations below 1674' so that a pumping test could be made of formations below said depth to determine content of lower formations as to oil and water. The final depth of mudding and cementing was dependent upon the results of the foregoing operations. Proposal was approved.

## Doheny-Pacific Petroleum Co.—Continued.

Well No. 2, Lease 1, shut off. T 3-58.

Pumping test for water shut-off satisfactory.

Well No. 2, Lease 1, bridge. P 3-127.

Proposal to bridge under 10" casing, to determine source of water, approved.

Well No. 6, Lease 1, shut off. T 3-6.

Test for water shut-off satisfactory.

Well No. 6, Lease 1, redrill. P 3-192.

Company proposed to mud formations between depths of 1121' and 1250' and hold the mud and water temporarily above 1250' with the 10" casing, for the purpose of making a pumping test, and to either cement the 10" casing at 1250' or make a further test of the same nature to determine the source of the water and final depth of mudding and cementing. Proposed operations approved.

Well No. 7, Lease 1, plug and bridge. P 3-73.

Plugging and bridging operations not conclusive as to source of the water. Recommended that the well be bridged again between depths of 1170' and 1220' in order to determine source of water.

Well No. 7, Lease 1, shoot. P 3-110.

Proposal to shoot with 250 lbs. gelatin, to increase production, approved with proviso that shot be placed at a depth greater than 1550'.

Well No. 10, Lease 1, shut off. T 3-3.

Test for water shut-off satisfactory.

Well No. 10, Lease 1, deepen. P 3-16.

Proposal to deepen approved under the following recommendations:

1. That the well be drilled as nearly "dry" as possible.

2. That the hole be drilled to a depth not to exceed 1950'.

3. That should water be encountered in drilling below the present depth of 1775' and the recommended depth of 1950' this department be notified immediately.

Well No. 10, Lease 1, supplementary, deepen. P 3-19.

Proposal to suspend deepening operations and test for productivity between the depths of 1830' and 1850' and later proceed to originally proposed depth, in event of no production in formations between 1830' and 1850', approved.

Well No. 10, Lease 1, plug and test. P 3-45.

Proposal to plug from 1850' to 1650' and later bridge under 12½" casing, if necessary, in order to determine source of water, approved.

Well No. 11, Lease 1, redrill. P 3-74.

Proposal to redrill bottom joint 12½" casing approved.

Well No. 11, Lease 1, shut off. T 3-69.

Test for water shut-off satisfactory.

Well No. 14, Lease 1, shut off. T 3-9.

Bailing test not conclusive. Well passed for pumping test of water shut-off.

Well No. 14, Lease 1, plug and test. P 3-46.

Well suddenly started producing 700 bbls. fluid per day of which 70% to 90% was water at 140° F. Proposal to plug bottom and also bridge under water string, if necessary, in order to determine source of water, approved.

Well No. 14, Lease 1, pumping test. P 3-69.

Proposal to make pumping test, in order to determine efficacy of plugging operations, approved.

Well No. 14, Lease 1, pumping test. T 3-93.

See report No. P 3-46. At the end of 70 days pumping well produced 135 bbls. fluid per day running 8.4 per cent water.

Well No. 15, Lease 1, shut off. T 3-50.

Test for water shut-off satisfactory.

Well No. 16, Lease 1, shut off. T 3-28.

Test for water shut-off satisfactory.

Well No. 17, Lease 1, shut off. T 3-30.

Test for water shut-off satisfactory.

## Doheny-Pacific Petroleum Co.—Continued.

Well No. 17, Lease 1, deepen. P 3-48.

Proposal to deepen to 1450' approved.

Well No. 27, Lease 1, shut off. T 3-37.

Test for water shut-off satisfactory.

Well No. 27, Lease 1, deepen. P 3-97.

Proposal to deepen to 1960' approved.

Well No. 27, Lease 1, deepen. P 3-115.

Proposal to deepen to 2015' approved.

Well No. 27, Lease 1, deepen. P 3-171.

Proposal to deepen Well No. 27 from 2015' to 2165' rejected unless work is done in stages and without an appreciable increase in water. Rejection of proposal for further deepening was based on data given below:

Doheny-Pacific Well	Depth	Depth below sea	Physical condition	Stratigraphic depth compared with No. 27, Lease 1	Daily production		Probable source of water
					Barrels oil	Barrels water	
No. 27, Lease 1-----	2115	1360	-----	-----	55	8	Bottom
No. 7, Lease 1-----	*1830	1301	*Plug 1925 to 1830	Same	18	5	Bottom
No. 4, Lease 1-----	1398	918	-----	Shallower	42	26	Top
No. 5, Lease 1-----	1494	1017	-----	Shallower	32	23	?
No. 4, Lease 2-----	1900	1338	-----	Shallower	44	13	?
No. 5, Lease 2-----	1710	1175	-----	Shallower (?)	43	17	Bottom
No. 6, Lease 2-----	1806	1280	-----	Shallower (?)	50	25	Bottom

Well No. 27, Lease 1, deepen. P 3-200.

Company proposed to deepen in 50' stages instead of 20' stages, as recommended in Report P 3-171. This department ruled as follows:

"From data at hand as per our Report P 3-171, Well No. 27, Lease 1, is stratigraphically as deep or deeper than the neighboring wells. Unless new data can be submitted to change this view or to show that the water now made by this well is either top water or water let into oil zone by some other well, the recommendation, of May 13, 1918, as per Report P 3-171, will be unaltered, except that at your option the well may be bailed dry after each 20' of deepening and left undisturbed at least 12 hours for bailing test by this department. This bailing test will, if you desire, eliminate the necessity of pumping the well for test."

Well No. 1, Lease 2, shut off. T 3-19.

Test for water shut-off satisfactory.

Well No. 1, Lease 2, land casing. P 3-55.

Company proposed to cement string of 8½" casing at 2450' in order to shut off water at 2307'. Recommended sealing all formations (shale) with cement, between depths of 1910' and 2450', in order to protect strata from which Union Oil Company Well No. 2, Escole, was producing, sealing operations to be witnessed by representative of this department.

Well No. 1, Lease 2, cement. P 3-56.

Complying with recommendations in our report No. P 3-55, see above, sealing operations at this well were witnessed as follows:

"Hole tested for circulation. Got returns of muddy water. Casing set on bottom and tested with pumps to 300 lbs. pressure. Casing lifted 18".

"Started hydraulic lime at 4:12 p.m. Got fluid return at 3:14 p.m. Pump slowed down at 3:17 p.m. and stopped at 3:18 p.m. Mixture of 60 sacks hydraulic lime delivered. Fluid return at casing head throughout the delivery. Time 6 minutes.

"Set pipe on bottom and put in first plug at 3:20-30 p.m. Fluid return stopped. Pipe delivery line reconnected, and casing lifted off bottom 18", at 3:22-30 p.m. Time 4½ minutes.

"Delayed here, mixing 8 sacks cement, pumping water into mixing pans, etc. Casing lifted 6" more. Started pumps 3:30 p.m. Time 7½ minutes.

"Started delivery of mixture of 150 sacks cement 3:30 p.m. Pump down at 3:42 p.m. Started 3:42-45 p.m. Down 3:43 p.m. Time  $13\frac{1}{2}$  minutes.

"During delivery of cement the returning fluid was at first muddy water, showing traces of oil and gas. Toward end of delivery fluid changed to thin mud, slightly foamy.

"Set casing on bottom, took off elevators, and disconnected delivery line 3:45 p.m. Placed second plug, connected delivery line, put on elevators, and pipe lifted 18" at 3:48-50 p.m. Time  $5\frac{3}{4}$  minutes.

"Started water 3:48-50 p.m. Figured 153 bbls. necessary to drive plugs together. Toward end of water delivery fluid returning cleared up to muddy water.

"The following are successive pump pressures from beginning to end of water delivery:

3:48-50 p.m.— 4 lb.

4:23-00 p.m.— 60 lb.

4:26-30 p.m.—120 lb.

4:33-00 p.m.—250 lb.

4:36-00 p.m.—500 lb.

"Plugs together. Delivery 153 bbls. Time  $47\frac{1}{2}$  minutes. Pump down and casing dropped at 4:36 p.m. Pressure partly released and casing moved 6" to bottom. At 4:38 p.m. operation completed. Total time for lime and cement, 1 hour and 24 minutes.

"From the manner in which the work was performed, as well as the condition of the hole, shown from behavior of fluid returns at the surface, it is reasonable to conclude that the sealing operation was a success.

"The well was therefore passed for a test for water shut-off."

Well No. 1, Lease 2, bridge. P 3-70.

While drilling out below  $S\frac{1}{4}$ " shut-off for test the hole filled up 2000' with water. It was suspected that this water was coming from below cementing point. However, company's proposal to bridge just below  $S\frac{1}{4}$ " shoe in order to test for water shut-off was approved as most logical step in determining source of water.

Well No. 1, Lease 2, redrill. P 3-91.

Proposed to make further effort to bridge under the  $S\frac{1}{4}$ " casing. Approved.

Well No. 1, Lease 2, shut off. T 3-70.

In test for water shut-off of  $S\frac{1}{4}$ " casing on bridge proposed in Report P 3-91, the well showed small amount of water. It was concluded that this water was coming through bridge. It was decided to drill out bridge and note whether or not water increased. Bailed dry at 9:00 a.m. January 2d. At 9:00 a.m. January 3d found fluid level at 1700', showing that water had come in at average rate of 89 gals. per hour.

Started drilling on bridge at 11:00 a.m. January 3d. Drilled to 2492' and at 12:30 p.m. January 3d, found fluid level at 1235', showing that 465' of water had entered the hole during the two hours the plug was intact and the one and one-half hours after drilling started. This represented an average of 370 gals. per hour for the entire period, but the water came in much faster after the drilling was done.

From the above data it was concluded that the water which entered the hole came from formations below the  $S\frac{1}{4}$ " shoe and mostly leaked past the bridge.

Well No. 3, Lease 2, drill. P 3-177.

Proposed to make temporary shut-off with  $12\frac{1}{2}$ " casing and prospect ahead before making final shut-off with 10" casing. Proposal approved.

Well No. 3, Lease 2, shut off. T 3-127.

Temporary formation shut off at 396' with  $12\frac{1}{2}$ " casing to exclude water at 310', entering the hole at the rate of 50 bbls. per hour, in order to test formations between depths of 396' and 850' for water.

A 20" hole was drilled and about 220 cu. ft. mud was converted to mud fluid and placed behind the  $12\frac{1}{2}$ " casing at the surface.

The hole was drilled "dry" below 396'.

Bailing test showed the temporary shut-off to be successful and that formations between depths of 396' and 850' were dry.

When the prospecting operations are concluded it is the company's intention to mud and cement string of 10" casing and then remove the 12½" casing from the hole.

Well No. 4, Lease 2, shut off. T 3-57.

Test for water shut-off satisfactory.

Well No. 4, Lease 2, deepen. P 3-125.

Proposal to deepen well 75' approved.

Well No. 6, Lease 2, bridge and test. P 3-128.

Proposal to bridge and test water shut-off approved.

Well No. 6, Lease 2, shut off. T 3-111.

Bailing test showed no water coming in above bridge proposed in Report No. P 3-128.

#### T. 9 N., R. 34 W., S.B.B. & M.

##### SECTION 5.

Eagle Creek Syndicate.

Well No. 1, Dargie, drill. Report P 3-67.

Casing program approved.

##### SECTION 19.

Associated Oil Co.

Well No. 21, Peshine, deepen. P 3-6.

Proposal to deepen, drilling "dry," approved.

Well No. 31, Peshine, shut off. T 3-10.

Bailing tests showed the 12½" hole to be filling at the rate of about 1' per hour.

Deputy recommended running casing tester, as there was some old pipe in the hole. Casing tester was placed at bottom at 8:30 a.m. August 2, 1917. Tester was pulled at 11:30 a.m. August 2d and came up dry.

One pound of aniline (red) dye was put into the hole outside the 12½" casing at this time and the deputy recommended that the hole be drilled ahead (dry) 50' with the idea that if the water appearing in the hole were native to formations between the 12½" shut-off the flow would increase as the drill entered further into the shales, or that if there were a small leak around the shoe the dye would appear in the hole. The hole was drilled ahead 50' and bailed to bottom at 9:00 a.m. August 3, 1917. At 7:00 p.m. August 3, 1917, bailer was measured to new bottom at 1085' and came up empty. Bailer was run again and brought up about two gallons of water and a showing of tar.

It was concluded from the foregoing that the water appearing at the initial test was drilling water which, in drilling the 50' of new hole, was completely recovered from the shales in which it had been absorbed.

Well No. 41, Peshine, shut off. T 3-18.

Test for water shut-off satisfactory.

Well No. 42, Peshine, drill. P 3-93.

Requested more accurate elevation. Drilling program approved.

Well No. 42, Peshine, shut off. T 3-99.

Test for water shut-off satisfactory.

Well No. 42, Peshine, deepen. P 3-175.

Proposal to deepen from 1540' to 1670' rejected. Recommended deepening and testing by 30' stages.

Well No. 42, Peshine, deepen. P 3-194.

Company submitted additional data, see Report P 3-175, above, showing that Peshine No. 3 was drilled to a greater stratigraphic depth, than proposed for No. 42, without encountering water. This department therefore recommended to drill ahead "dry" 50' and at the new depth bail the hole dry and let stand 12 hours for test. Further deepening depends upon result of said test.

Well No. 51, Peshine, shut off. T 3-55.

Test for water shut-off satisfactory.

## Associated Oil Co.—Continued.

- Well No. 52, Peshine, drill. P 3-94.
- Proposed drilling program approved.
- Well No. 52, Peshine, shut off. T 3-120.
- Well No. 61, Peshine, drill. P 3-92.
- Proposed casing program approved.
- Well No. 61, Peshine, shut off. T 3-129.
- Test for water shut-off satisfactory.
- Well No. 137, Peshine, drill. P 3-95.
- Proposed drilling program approved.
- Well No. 137, Peshine, shut off. T 3-119.
- Test for water shut-off satisfactory.

## SECTION 20.

## Associated Oil Co.

- Well No. 1, Peshine, shut off. T 3-2.
- Test for water shut-off satisfactory.
- Well No. 3, Peshine, drill. P 3-174.
- Proposed casing program approved.
- Well No. 3, Peshine, shut off. T 3-117.
- Temporary formation shut-off made with 12½" casing at 128' shoe driven 20' into blue shale. Hole drilled dry to 1324'. Hole bailed dry for test and showed no water was encountered below depth of temporary shut-off.
- Well No. 3, Peshine, shut off. T 3-126.
- As set forth in report No. T 3-117 no water was logged below depth of 128'. 10" casing was mudded and cemented at 1324'. Test for water shut-off satisfactory.

## TODOS SANTOS RANCHO.

## Shell Company of California.

- Well No. 1, Newhall Tract, drill.
- Proposed drilling program approved.
- Well No. 1, Newhall Tract, shut off. T 3-32.
- Test for water shut-off satisfactory.
- Well No. 1, Newhall Tract, drill, supplementary. P 3-57.
- Proposal to cement string at 10" casing at 1840' instead of 12½" 45-lb. casing at 2000' approved.
- Well No. 1, Newhall Tract, shut off. T 3-49.
- Test for water shut-off satisfactory.
- Well No. 1, Newhall Tract, shut off. T 3-97.
- Test for water shut-off satisfactory.
- Well No. 1, Newhall Tract, cement. P 3-117.
- Supplementary proposal to cement 10" casing at 2795' approved.
- Well No. 1, Newhall Tract, drill, supplementary. P 3-169.
- Proposal to cement string of 8½" casing at 3245' approved.
- Well No. 1, Newhall Tract, drill, supplementary. P 3-195.
- Proposal to prospect ahead and determine depth of next shut-off approved.

## Union Oil Company of California.

- Well No. 2, Escolle, cement. P 3-51.
- Proposal to cement string of 8½" casing at 1860' approved.
- Well No. 3, Escolle, shut off. T 3-56.
- Test for water shut-off satisfactory.
- Well No. 4, Escolle, shut off. T 3-101.
- Test for water shut-off satisfactory.
- Well No. 6, Escolle, shut off. T 3-26.
- Test for water shut-off satisfactory.
- Well No. 7, Escolle, drill. P 3-87.
- Proposed casing program approved.

## Union Oil Co.—Continued.

Well No. 7, Escolle, shut off. T 3-95.

Test for water shut-off satisfactory.

Well No. 8, Escolle, drill. P 3-132.

Proposed casing program approved.

Well No. 8, Escolle, shut off. T 3-100.

Test for water shut-off satisfactory.

Well No. 9, Escolle, drill.

Proposed drilling program approved.

Well No. 9, Escolle, drill, supplementary. P 3-134.

Amending stated location of well; proposed casing program approved.

Well No. 9, Escolle, shut off. T 3-123.

Test for water shut-off satisfactory.

Well No. 10, Escolle, drill. P 3-162.

Proposed drilling program approved.

Well No. 11, Escolle, drill. P 3-163.

Proposed drilling program approved.

T. 9 N., R. 35 W., S.B.B. & M.

PUNTA DE LA LAGUNA RANCHO.

## Associated Oil Co.

Well No. 4, Morganti, drill. P 3-119.

Proposed casing program approved.

Well No. 4, Morganti, drill, supplementary. P 3-126.

Casing estimates changed on account of reported error in elevation. Revised estimates approved.

Well No. 4, Morganti, shut off. T 3-114.

In making bailing test for water shut-off with 12½" casing at 960' it was found that the fluid level had risen 521' in 12 hours. The test indicated that another water stratum had been entered or else the shut-off was a failure. However, in view of the fact that no water had been logged at this stratigraphic depth in neighboring wells and 150 sacks of cement had been used for a shut-off, this department decided that the water was coming into the hole from some source other than around the shoe and strongly urged the company to test casing for collar leaks due to insufficient tightening.

The company ran a casing tester and found casing leaking at the rate of 670 gals. per day. The casing was screwed up 26 inches. After casing was tightened the tester showed one pint of water at a depth of 945' in one-half hour.

Well No. 4, Morganti, shut off. T 3-132.

The 10" 40-lb. casing was mudded and cemented at 1472'. It was reported that the hole below 960' was mudded, using a large quantity of mud, but that the mud *did not appear* at the surface. The foregoing is an indication of the porosity of the fracture zones in the Casmalia field shales. Shales were mudded for the purpose of preventing surface waters from working down through fractures into the oil zone.

Test for water shut-off satisfactory.

Well No. 5, Morganti, drill. P 3-189.

Proposed casing program approved.

Well No. 25, Morganti, drill. P 3-120.

Proposed casing program approved.

Well No. 33, Morganti, drill. P 3-190.

Proposed casing program approved.

Well No. 34, Morganti, drill. P 3-121.

Proposed casing program approved.

Well No. 43, Morganti, shut off. T 3-68.

Test for water shut-off satisfactory.

Well No. 43, Morganti, shut off. T 3-102.

Test for water shut-off satisfactory.

## Associated Oil Co.—Continued.

Well No. 45, Morganti, cement casing. P 3-25.

Proposal to cement string of 8½" casing approved.

Well No. 45, Morganti, make pumping test. P 3-109.

Proposal to make pumping test in lieu of bailing test approved.

Well No. 45, Morganti, shut off. T 3-80.

Pumping test; see P 3-109 for water shut-off not satisfactory. Approval withheld awaiting further results of pumping.

Well No. 53, Morganti, shut off. T 3-44.

Test for water shut-off satisfactory.

Well No. 53, Morganti, shut off. T 3-62.

Test for water shut-off satisfactory.

Well No. 54, Morganti, shut off. T 3-38.

Test for water shut-off satisfactory.

Well No. 54, Morganti, shut off. T 3-48.

Test for water shut-off satisfactory.

Well No. 55, Morganti, shut off. T 3-54.

Recommended mudding and cementing another string of casing.

Well No. 55, Morganti, shut off. T 3-82.

Test was made to determine practicability of mudding formations back of 10" casing, see report T 3-54. Pumps could only deliver 1 bbl. of water per minute into formation, under 300 lbs. pump pressure, and it was therefore decided mudding was not necessary.

Well No. 55, Morganti, shut off. P 3-159.

Proposal to mud and cement string of 8½" casing approved.

Well No. 55, Morganti, shut off. T 3-115.

Bailing test impracticable account of heaving shale and rise of oil fluid. Well passed for pumping test.

## Pinal Dome Oil Company.

Well No. 1, Elizalde, abandon. P 3-5.

Proposal to abandon approved.

## Union Oil Company of California.

Well No. 2, Elizalde, drill.

Proposed casing program approved.

Well No. 2, Elizalde, shut off. T 3-83.

Test for water shut-off satisfactory.

## SECTION 3.

## United Western Consolidated Oil Co.

Well No. 1, shut off. T 3-12.

Test for water shut-off satisfactory. Bailer showed 5 gals. black sulphur water.

Well No. 1, drill, supplementary. P 3-168.

Proposal to cement 8½" casing at 1627' in order to test for productivity of formations below that depth approved.

Well No. 1, shut off. T 3-122.

Test for water shut-off satisfactory.

## SECTION 14.

## Contra Costa Oil Syndicate.

Well No. 1, drill. P 3-111.

Proposed drilling program approved.

## QUINTERO LEASE.

## Union Oil Company of California.

Well No. 1, shut off. T 3-42.

The company reported that 12½" 40-lb. casing collapsed, after cementing and bailing at about 1200'. The casing was swaged. Bailing test showed water coming into the hole. The well, being a prospect well, was passed for further drilling, with the understanding that in case productive formations were entered another string of pipe would be cemented to protect same.

T. 10' N., R. 35 W., S.B.B. & M.

Standard Oil Company.

Well No. 1, abandon. P 3-22.

Work of abandonment approved identically as proposed.

Well No. 1, abandon. P 3-114.

Requirements of department, for abandonment, based on all information filed, have been complied with.

TOGNAZZINI LEASE.

Standard Oil Company.

Well No. 1, abandon. P 3-23.

Proposal to plug and abandon approved.

Well No. 1, abandon. P 3-113.

Requirements of department, for abandonment, based on all information filed, have been complied with.

## CHAPTER VI.

## KERN, TULARE AND INYO COUNTIES.

By R. N. FERGUSON, Deputy Supervisor.

**District.**

In the district, covered by Kern, Tulare and Inyo counties, the developed oil fields all lie within the boundaries of Kern County. There are four groups of fields in all. In certain instances the groups contain several more or less distinct fields. The Kern River field is the only field on the east side of the San Joaquin Valley. On the west side of the valley there are the Sunset-Midway-McKittrick group of fields; the Belridge-North Belridge, or Hopkins-Lost Hills group, and the Devils Den field which is as yet undeveloped.

**Organization.**

The work of this department for the fields mentioned, is conducted from the office of the State Mining Bureau at Taft. A branch office is maintained at Bakersfield for the purpose of facilitating inspection, witnessing tests of water shut-off, and other field work required by law. All field work on the west side of the valley is handled by engineers and inspectors working out of the office at Taft.

**General Summary.**

During the year there were 435 new drilling wells reported as compared with 682 wells during the year previous. This falling off in drilling activity was general throughout all fields except Sunset where a decided increase was shown. In the Lost Hills and Kern River fields the decrease was partly due to the completion of drilling campaigns by certain companies but in general it was ascribed to scarcity of drilling materials. There were 364 wells deepened or redrilled during the year. This is a slight increase over this class of jobs for the year previous. There is little change in the number of abandonments as compared between this year and last year.

The number of decisions issued on proposed operations and tests for water shut-off are a good indicator of the amount of work required of this department in the various fields. In addition to this more or less routine work the task of assembling data and making special investigation of a number of formal complaints has been a large one.

Table No. 1, which follows, summarizes the operations that have been carried on in the various fields of the district during the year:

TABLE I. OPERATIONS DISTRICT FOUR, 1917-1918.

Field	New wells		Deepen or redrill		Abandon		Test shut-off		Special tests
	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions	Decisions
Sunset	95	133	54	68	13	33	139	191	62
Midway	204	223	170	206	53	59	278	371	61
McKittrick	19	32	23	25	8	9	30	42	5
Belridge	47	83	14	16	5	7	79	101	4
North Belridge	16	28	4	5	2	2	12	21	
Lost Hills	22	40	22	27	7	14	19	35	1
Kern River	30	32	76	89	8	11	71	84	24
Wild Cat	2	3	1	1	1	1	1	1	1
Totals	435	579	364	438	97	136	628	846	161

Total reports on proposed operations... 579 ÷ 438 ÷ 136 = 1,153

Total reports on tests... 1,067 846 161

Total decisions issued... 2,169

### Records.

The status of records furnished the department, to the end of the fiscal year, is shown in Table II. It will be noted that the production reports filed account for 4458 wells. Our information from other sources is to the effect that 4837 wells in the district are producing oil. The production reports therefore account for 95 per cent of the producing wells and 63 per cent of all wells drilled.

TABLE II. Records Filed.

Field	Wells drilled, completed, idle, and abandoned	Logs filed	Number of wells accounted for by production reports	Number of producing wells for which production reports are filed
Sunset	828	304	461	411
Midway	2,450	1,915	1,326	1,229
McKittrick	580	377	207	265
Belridge	263	187	152	142
North Belridge	40	27	19	19
Lost Hills	447	340	340	337
Kern River	2,456	1,849	1,953	1,883
Wild Cat	25	5		
Totals	7,099	5,091	4,458	4,223

### Appeals to Commissioners.

During the year the Board of Commissioners heard one *informal* appeal from a recommendation of the Deputy Supervisor and one formal appeal from an order of the State Oil and Gas Supervisor.

The *informal* appeal was that of Baker & Henshaw from the recommendation of the deputy in the matter of the method of abandonment of Baker and Henshaw well No. 2, Section 12, T. 26 S., R. 20 E., M. D. B. & M., as contained in report No. P-4-927, dated December 22, 1917. The recommendation appealed from was as follows:

"The well should be cleaned out to original bottom, 1880', the bottom of the hole should be thoroughly mudded under pressure and a cement plug placed from 1880' to 1845'. The hole should then be plugged with clay up to 1800' and a cement plug placed at that depth after which the plugging with clay should proceed up to a depth of 1600' where another cement plug should be placed. The hole should then be plugged with clay up to 1265' where a cement plug should be placed that will extend up into the 8½" casing at least 10' or to 1243'. The 8½" casing should then be freed and pulled up and the formations below the shoe of the 10" casing (landed at 1211') should be thoroughly mudded under a pressure of 400 lbs. If the 10" casing can be loosened it should be pulled and a cement plug placed against the walls of the hole from 1210' to 1195'. If the 10" can not be loosened, it should be shot between 1210' and 1195' and the shot cavity filled with cement. If the 10" casing can be freed it should be pulled, and as it is pulled back, the hole should be mudded under pressure. In the event it does not free, the 10" should be ripped at the following depths (or until it comes free): 1180'-1195', 1030'-1130', 870'-1010', 730'-812', 570'-620', and mud pumped out through the rips under pressure. A cement plug should be placed against the walls of the hole from 870' (shooting the 10" casing if necessary) up in 12½" casing to 550'. If the 12½" casing can not be freed at 550', it should be shot and a solid cement plug placed against the walls of the hole between the depths of 480' to 550'. A cement plug should be placed against the walls of the hole between 400' and 457' and between 365' and 377'. The hole should then be mudded under pressure and a solid clay plug placed against the walls of the hole from 365' up to 147'. The hole should then be filled with surface formation to the top."

The hearing was held on March 20, 1918, and the decision of the commissioners was as follows:

"That Baker and Henshaw be required to clean the well out to a depth of 1670', either by rotating down with tubing or by carrying a string of casing, and pump in sufficient cement to fill the hole up to within 15' or 20' of the shoe of the 8½" casing, in the presence of a representative from the State Mining Bureau, and that the abandonment of the hole from that point be done in accordance with the recommendation of the Deputy Supervisor, making use of any modification of previous recommendations that seem warranted by the developments resulting from the work on the lower portion of the hole."

A further hearing of the case was held on April 24, 1918, at which time Baker and Henshaw requested certain modifications in the work outlined. The commissioners reaffirmed their decision of March 20, 1918.

The formal appeal, above referred to, was that of Union Oil Company from Order No. 5 of the Supervisors relative to method of drilling, prospecting, and shutting off water in well No. 7 (International), Section 4, T. 11 N., R. 23 W., S. B. B. & M. The commissioners, at a special meeting on May 4, 1918, reversed the order of the Supervisor and upset all previously accepted practices as to the protection of oil sands from infiltrating water. The matter is fully set forth as follows:

**ORDER NUMBER FIVE—STATE OIL AND GAS SUPERVISOR.**

April 22, 1918.

*To Union Oil Company of California:*

The question as to the proper method of drilling oil wells with a view to protecting the oil deposits in the vicinity of Sec. 4, T. 11 N., R. 23 W., S. B. B. & M., in the Maricopa Flat, Kern County, California, has been particularly brought to the attention of the State Oil and Gas Supervisor on several occasions. The method pursued or proposed by the Union Oil Company in the drilling of wells in the said locality has been the subject of much correspondence and discussion between the Supervisor and said Company, and other companies operating in the neighborhood.

The question was first brought particularly to the attention of the Supervisor by letter of complaint dated August 23, 1916, and written by Howard M. Payne, Receiver.

The question was made the subject of a public conference at Taft, California, on July 27, 1917, which was held at the request of the Union Oil Company. The Supervisor presided at the meeting, which was attended by representatives of the Union Oil Company and by representatives of other concerns operating in the aforementioned locality. A complete written record of the proceedings was kept in such form as to show all correspondence beginning with the original letter of complaint, dated August 23, 1916, and also all remarks made. A copy of the written record was furnished to the Union Oil Company and to other operators; a copy is on file with the Supervisor, and reference is hereby specifically made to said record.

The record of the said public conference shows that International well No. 6, belonging to the Union Oil Company, was the special subject of discussion. The record also shows that previous to that time, namely, on November 1, 1916, the operators of the locality had held a meeting for the purpose of discussing methods of protecting the oil

deposits, and advising the Supervisor as to their opinions. Written opinions were furnished to the Supervisor by several parties, but not by the Union Oil Company, and the record does not disclose whether or not the said Company was at that time co-operating with the neighboring operators. An assumption that there had not been complete co-operation seems justified by statements of representatives of the Union Oil Company at the meeting of July 27, 1917 (page 134 of transcript), to the effect that objections and opinions of neighbors had not previously come to the attention of said company.

The record shows that under date of November 28, 1916, after receipt of written opinions from various operators, the Supervisor formulated a policy for protecting the oil deposits. The said policy specified two methods of drilling wells for two different underground geological conditions. One method provided that a string of casing should be cemented and tested above the top producing oil sand; the second method provided for cementing a string of casing below the top oil sand in case certain formations were found to be more than 400 feet apart.

In view of all the facts before the Supervisor after the public conference of July 27, 1917, a written recommendation and requirement as to the method of drilling International well No. 6 was furnished to the Union Oil Company by Deputy Supervisor R. N. Ferguson, under date of July 28, 1917. Said recommendation and requirement provided for cementing and testing a string of casing above the top sand, and definitely rejected a proposal to carry the casing below said top sand. The recommendation and requirement were based upon further study, investigation and new facts, and it therefore amended the policy of November 28, 1916, and eliminated the alternative method which allowed casing to be cemented below the top sand. Since the issuance of the recommendation and requirement of July 28, 1917, approval has been given only to proposals to land and cement above the top sand. The previously announced alternative method of cementing casing below the top sand was abandoned because it was found that in the case of a failure of water shut-off, by use of mud and cement, it is difficult, if not impossible, to protect the said top sand. This was specifically demonstrated in March, 1917, at Pat Welch well No. 4, on Sec. 4, and at Southern Pacific well No. 31, on Sec. 5, all in T. 11 N., R. 23 W., S. B. B. & M.

The policy of requiring that casing be cemented above the top sand was again definitely stated in writing by Deputy Supervisor R. N. Ferguson, under date of August 24, 1917, in a formal report to the Union Oil Company, in reply to their proposal to drill International well No. 7, said proposal bearing date of August 21, 1917. The Union

Oil Company agreed to said policy and ruling, as is shown in their proposal dated January 13, 1918, which states that the intention had previously been to cement the 10-inch casing at a depth of 2840 feet.

The Union Oil Company, however, proposed, under date of January 13, 1918, to complete International well No. 7 by a method not in accord with the policy requiring that casing be cemented and water shut off immediately above the top oil sand. The reason of the company for wishing to depart from the policy is that it has failed in its proposed program of mechanical operations at said well No. 7. No facts are set forth tending to show that the underground geological conditions as to water and oil sands are different from those originally assumed in formulating the policy for protection.

It can not be too emphatically and clearly set forth that, if failure of an operator to successfully carry out a mechanical operation were to be accepted as excuse for altering requirements, the legal regulation of drilling operations would immediately fall to the standard of operations set by the most inefficient operator in the State, and the law would be rendered null and void. The tendency to excuse and assist an operator who has been unfortunate in mechanical operations is a constant temptation to any official who desires to assist operations rather than to simply retard and drastically regulate them. Therefore, the logical outcome of any policy must be kept clearly and constantly in mind.

Sec. 3, Chapter 718, Statutes of 1915, amended 1917, reads as follows:

"It shall be the duty of the state oil and gas supervisor so to supervise the drilling, operation and maintenance and abandonment of petroleum or gas wells in the state of California, as to prevent, as far as possible, damage to underground petroleum and gas deposits from infiltrating water and other causes and loss of petroleum and natural gas."

After the mechanical difficulty which prevented the Union Oil Company from carrying the 10-inch casing deeper than 2570 feet, or about 270 feet above the probable position of the top sand, there was considerable discussion between representatives of the company and the Supervisor as to the method of completing the well. An agreement was not arrived at, and the company requested that the matter be referred to the District Oil and Gas Commissioners.

In order to place the matter formally before the said Commissioners, it became necessary, according to the provisions of the law, for the Supervisor to issue a formal order directing certain procedure at the well. For the purpose of assembling and considering all evidence upon which a formal order should rest, a formal hearing was held by the Supervisor at Taft on April 9, 1918. A complete written record of the proceedings was kept, and is hereby referred to.

The District Oil and Gas Commissioners were notified to attend, and did attend, the hearing for the purpose of being fully informed should the order of the Supervisor be appealed to them.

The assembling of evidence as to underground conditions was considered to be of such importance that the Supervisor detailed several engineers and geologists from other districts of the State to the study of the subject at hand. All but purely routine work in the fourth district was laid aside in order that this particular locality could be investigated. The Union Oil Company was given notice that complete technical and geological information would be gathered, and that the Supervisor hoped that the company would co-operate in such work to the same extent that neighboring operators had already done. The Supervisor has repeatedly called the attention of the company to the fact that engineering and geological study of a locality must precede and accompany the mechanical work of drilling if oil deposits are to be properly protected from damage. Notwithstanding the requests for co-operation in technical work, the company failed to give it. The extent of such failure may be judged by the fact that the company did not even furnish a map accurately showing the location and elevation of its own wells. The failure of the company to co-operate in the matter of technical information is further shown by the fact that at the formal hearing the company was represented solely by its superintendent, Mr. George Kammerer, who is highly skilled in the mechanical details of well drilling, but lays no claim to knowledge of engineering or geology.

The disadvantage and nervous strain under which Mr. Kammerer labored in attempting single-handed to present his contentions and opinions on technical subjects was one of the most lamentable features of the hearing. That the officers of a company as large as the Union Oil company should have so little knowledge or concern as to the difficulty of correctly ascertaining the facts governing the protection of oil deposits is the most astounding feature of the inquiry. If a studied effort had been made by the officers of the company to discredit the administration of the law, the result could not have been better achieved than by placing their sole representative in such a position of tension and anxiety that he did repeatedly make contemptuous and derogatory remarks as to the fairness and integrity of the officers of the law.

The extent to which the company is uninformed as to invisible underground conditions and facts vitally affecting the control of water at their oil wells may be judged by certain testimony of their representative, Mr. Kammerer (page 149 of transcript), relative to ground surface conditions readily observable at International well No. 5:

“MR. McLAUGHLIN. In this particular well, No. 5, is there not water flowing outside the casing?

MR. KAMMERER. If there was I don't know it.

MR. McLAUGHLIN. I was at the well yesterday, and I thought there was water outside of the casing.

MR. KAMMERER. No.

MR. McLAUGHLIN. Maybe we were mistaken."

Since the hearing, a representative of the Supervisor, Mr. McGregor, petroleum engineer, has visited said well No. 5 and actually confirmed the observation of the Supervisor that water is flowing from behind the casing.

The hearing was conducted for the purpose of considering the physical facts as to underground conditions at International well No. 7, belonging to the Union Oil Company. The facts are developed by study of the observed conditions in wells of the immediate vicinity, and are as follows:

1. There is an anticlinal fold in the formations underlying the land in question. The axis of the fold runs southeasterly through a point near International well No. 4. The axis of the anticline plunges or becomes lower as it is followed toward the southeast.

2. The number of strata carrying either water or oil is extraordinarily great and presents one of the most difficult problems encountered in California, so far as protection of oil sands from damage by water is concerned. However, detailed and careful study shows remarkable persistence and regularity of geological conditions. There are no less than nine separate and distinct beds of sand carrying oil and occurring within a vertical range of about 900 feet. There are at least three strata or groups of strata carrying water. For convenience of description, the oil-bearing strata have been grouped into three zones. The water-bearing zones have been chosen as the division lines between the three oil-bearing zones.

Zone "A" is the uppermost or top oil sand, and is less than 100 feet in thickness. Less than 50 feet above it is a zone carrying water and referred to as the "lowest top water."

Zone "B" is almost 100 feet below zone "A," and is nearly 200 feet thick. Between zones "A" and "B" is a water-bearing zone referred to as the "upper flowing water."

Zone "C" is about 400 feet thick, and is about 100 feet below zone "B." Between zones "B" and "C" is a water-bearing zone referred to as the "lower flowing water."

3. Zone "A" has been encountered and identified in at least twenty-three wells on portions of Sections 4 and 5, T. 11 N., R. 23 W., and Section 32, T. 12 N., R. 23 W., S. B. B. & M., and immediately adjoining the property of the Union Oil Company known as the "International," being the southeast quarter of the northwest quarter of Section 4, T. 11 N., R. 23 W., S. B. B. & M. One well, namely, International No. 1, directly upon the said International property, encountered and actually produced oil from zone "A."

Testimony of witnesses was practically unanimous in the opinion that zone "A" extends under the International property.

At least twenty-two of the wells in the aforesaid sections 4, 5 and 32, have produced oil from zone "A." The total production has been not less than 1,433,173 bbl. of oil ranging from 18° to 22° Baumé. The average daily production of individual wells ranges from 38 to 500 bbl. of oil. There have been about 496,417 bbl. of water lifted with the oil from zone "A," or about one bbl. of water to every three bbl. of oil. The thickness of the productive oil sand in zone "A," as reported by logs of wells, ranges from 3 to 20 feet, the average being 10 feet.

4. Zone "B" has been encountered in at least nine wells in said Sections 4, 5 and 32. Five of the wells have produced a total of at least 1,226,850 bbl. of oil ranging

from 24° to 26° Baumé. The average daily production of individual wells ranges from 50 to 520 bbl. of oil. There have been about 224,002 bbl. of water lifted with the oil from zone "B," or about one bbl. of water to every six bbl. of oil. The thickness of the productive oil sands, as reported by logs of wells, ranges from 6 to 15 feet, the average being 10 feet.

5. Zone "C" has been encountered in at least 26 wells in said sections 4, 5 and 32. Twenty-four of the wells have produced a total of at least 12,175,550 bbl. of oil ranging from 18° to 27° Baumé, most of it being above 24°. The average daily production of individual wells ranges from 5 to 30,000 bbl. of oil. There have been about 1,211,995 bbl. of water lifted with the oil from zone "C," or about one bbl. of water to every 10 bbl. of oil. The thickness of the productive oil sand, as reported by logs of wells, ranges from 6 to 86 feet, the average being 22 feet.

6. Records of drilling operations show that at none of the wells drilled by the Union Oil Company on the International property were proper and sufficient tests made for the purpose of proving or disproving the presence of zone "A." The Company states that considerable sums of money were spent in conducting tests and trying to locate zone "A," but in the face of records showing that water had access to the formations at the time search was conducted, it would have been difficult, if not impossible, to establish the nature of the formations. It is not an uncommon occurrence for wells to pass through productive oil formations without discovering their nature, and the mere expenditure of money can not be considered as a detailed test or search. Furthermore, diligent inquiry on the part of the Supervisor has failed to disclose that the Union Oil Company made careful geologic study and comparison of well logs in the locality. Thorough geologic study has been shown to be a necessary step in the discovery and identification of zone "A." Such a study would necessitate data accurately locating all wells and showing their elevations, and as the Company could not furnish the Supervisor with such primary information, we are justified in stating positively that the Company had not made careful geologic study and comparison in the effort to locate zone "A."

The large production obtained from zone "C" is ample explanation for a policy which would temporarily disregard the possibilities of smaller profit from zone "A," and earnest, but misdirected, efforts to find zone "A" might readily lead to a belief that it did not exist. There is, however, ample evidence both of the existence and value of zone "A," and the Supervisor is therefore not justified in approving methods of drilling which do not protect it so far as possible from water. It is not the intention of the Supervisor to insist that the Company shall produce from either zone "A" or zone "B."

7. The cost of casing is the largest single item of expense in the drilling of wells, and is sometimes increased where extra precautions are taken to protect formations from water. In this locality, however, a comparison of casing costs at seventeen wells shows that wells which definitely located zone "A" before drilling to zone "C" each cost, on the average, \$254 more than those which did not definitely locate zone "C." The average cost of casing in the latter case is \$22.035, and therefore the increased cost is about one per cent.

8. It is impossible, under methods previously followed, for the Company to correctly determine the nature of formations passed through in drilling. This is demonstrated by comparison of the logs of International wells Nos. 2 and 6, which are located less than 30 feet apart, but fail to record the same formations, although it is practically a certainty that actual conditions in the wells are not only similar, but identical.

9. As has already been shown, water in considerable quantities and proportion has been given access to zone "A." Therefore, some damage to the zone has already been done, and in the light of other similar conditions, the damage may at any time reach great proportions. Protective measures can not be postponed awaiting overwhelming damage.

10. Comparison of the amounts of water produced from each of the various wells herein mentioned, and situated in Sections 4, 5 and 32, shows that all of the Inter-

national wells of the Union Oil Company are producing water in large and damaging amounts. Furthermore, the said wells of the Union Oil Company show larger amounts of water than most of the other wells within the neighborhood. This condition may directly affect the well covered by this order, and notice is hereby given that the Supervisor will expect proposals at an early date looking to the testing and repairing of various International wells. When water trouble develops at a well, the first and most obvious place, in the absence of other evidence, to look for the cause, is within the well itself.

### CONCLUSION.

The present shortage of oil, as well as casing, gives cause for serious reflection before the issuance of an order which either postpones the production of oil or requires an increase in the amount of casing to be used. On the other hand, the protection of the oil bearing deposits is of prime necessity, particularly at the present stage of national necessity.

It is believed that more prompt and satisfactory agreement between an operator and the Supervisor can be arrived at by less formal methods than have been followed in this case, *providing* the operator is prepared to meet the Supervisor in the matter of co-operation in the necessary engineering and geological work. As previously intimated, the Supervisor is prepared to insist that the highest standard of operating methods shall be followed. In fairness to the Union Oil Company, it may be said that certain of its statements and actions, not concerned in the matter immediately under consideration, indicate that in future their work will be preceded by technical investigation and direction equal to the best usage of other operators and therefore equal to the standard required by the Supervisor.

Conditions at International well No. 7, as shown by proposals, reports and correspondence passing between the company and the Supervisor, are as follows:

The Company proposed (August 21, 1917) to drill the well to encounter oil sand (zone "C") at a depth of 3375 feet; water to be shut off by cementing 10-inch casing at a depth of 2900 feet and 8½-inch casing at 3300 feet.

The Supervisor recommended (August 24, 1917) that 10-inch casing be landed at about 2800 feet and above the top oil sand (zone "A"). The Supervisor later (October 22, 1917) approved proposal to land the water string as deep as 2850 feet.

After mechanical trouble, which left the 10-inch casing cemented at 2570 feet and the bottom of the hole at 2840 feet, the Company (January 13, 1918) proposed to test for water immediately below the 10-inch casing, and, if no water was found there, to make another test for water with perforated casing open to a depth of 2840 feet. If the latter test showed no water, drilling was to continue to a depth of 3375 feet. No mention of test or protection of zone "A" was made.

The Supervisor (January 17, 1918) approved the two proposals to test for water, but in addition recommended that if it were found, which contingency was not covered by the proposal, it should be shut off by cementing 8½-inch casing at 2840 feet. It was also recommended that, with water either absent above or shut off at 2840 feet, the well should be drilled to a depth of 2875 feet and tested for oil (zone "A"). If the test for oil did not discover it, drilling was to proceed to 3375 feet.

The company wrote (January 26, 1918) that they preferred to use 6½-inch casing instead of 8¼-inch casing to a depth of 2840 feet, as it could be more easily removed.

The Supervisor wrote the company (January 26, 1918) that no proposal to pull casing was on file.

The company wrote (January 30, 1918) explaining why 6½-inch casing could be more easily removed. The letter further stated that with casing cemented at 2840 feet, the hole would be ruined so far as reaching the deeper (zone "C") sand.

The Supervisor (January 30, 1918) wrote the company that the productiveness of zone "A" in adjoining wells demanded its protection by cementing at 2840 feet, and that the larger sized casing would be advisable. Although the letter did not specifically point out that the use of the larger size casing would permit drilling to the deeper (zone "C") sand, attention is hereby directed to that fact.

Subsequent correspondence was relative to hearing, formal order and appeal.

The company (April 5, 1918) proposed to carry 8½-inch casing to 3300 feet, as they did not want to "waste any more time to test out first oil sand." This proposal was actually received by the Supervisor on the date of the investigation and hearing. It indicates little except irritation at any regulation based on an investigation into facts, and was therefore disregarded by the Supervisor.

It will be noted from the previous facts that had the company merely acceded to the recommendation of the Supervisor in the use of 8¼-inch casing, the well would doubtless have been completed some time since and would now be producing from either zone "A" or zone "C."

It will also be noted that various proposals by the company were indefinite or incomplete, in that they did not cover all their proposed operations, nor did they provide for contingencies aside from the limited underground conditions assumed by the company.

Although there is lack of definiteness in written proposals and letters, it appears that quite recently the company has been willing to make some tests for the purpose of proving or disproving the existence and productiveness of zone "A" at International well No. 7. Assuming such intent, it is necessary, in view of the character of previous operations by the company, to specify rigid tests establishing the nature of the formations. It is also necessary to specify certain depths between which said tests shall be made. The depth must include a greater thickness of formations to be tested than would appear to have been contemplated by the company in limiting its willingness to conduct tests.

*It is therefore hereby ordered* that the following operations shall be performed for the purpose of definitely locating the first or top productive oil sand, and for the further purpose of excluding from it all waters encountered at lesser depths in the well.

1. Effect a water shut-off by cementing a string of casing at a depth of 2840 feet in the following manner:

- (a) Clean well out to depth of 2840 feet.
- (b) Cement casing at 2840 feet with sufficient cement to reach up to a depth of 2810 feet.
- (c) Allow cement to set for at least 10 days.

(d) Drill out cement to a depth not to exceed 2845 feet.

(e) Bail fluid and test in the usual manner.

2. After a water shut-off has been made at 2840 feet and approved by the Supervisor, the company shall drill, with cable tools, to a depth not to exceed 2860 feet, and make conclusive pumping or bailing tests to determine whether formations between said depths of 2840 and 2860 feet carry either oil or water.

3. Drilling and testing of 15-foot zones of formation shall be continued, in the same manner as hereinbefore specified, until either oil or water-bearing formations are encountered.

4. In the event that in any of the aforespecified drilling and testing operations oil is discovered, the company shall tube the well to a depth satisfactory to the Supervisor and pump same for a period of not less than fifteen days, gauging the production by means of one or more tanks determining accurately the production of oil and of water for each twenty-four hour period during the fifteen days.

5. If, in the aforementioned deepening by 15 foot stages, water-bearing formations are encountered, the hole shall be effectively plugged with cement from the bottom to a depth of 2830 feet. Said plug shall be so constructed as to prevent the upward passage of water into the casing cemented at 2840 feet, and shall be tested to demonstrate its effectiveness. Said test of plug shall be made by removing all fluid from the well to a depth of 2500 feet, and allowing the well to stand for at least twelve hours. After said plug has been tested and approved as effective, the top of the plug shall be cleaned by running a suction pump of the Morahan type. The casing shall then be ripped for the purpose of determining whether or not oil-bearing formations exist above a depth of 2840 feet. There shall be not less than two holes ripped in the casing, each hole to be not less than five feet long, extending between depths of 2825 feet and 2820 feet. After ripping, suction pump shall be run to determine that formation has entered the casing through the rips. In the event that said ripping does not allow the entrance of formation, five pounds of gelatine shall be exploded at a depth of 2822 feet. After it has been demonstrated that formation has entered the casing, the well shall be bailed to determine the presence or absence of oil. In the event that oil is thus shown to exist above a depth of 2840 feet, it will be necessary to protect it from water to the satisfaction of the Supervisor.

6. In the event that no oil-bearing formations are discovered by the hereinbefore specified tests, the well shall be redrilled and casing cemented below the lowest water-bearing formations previously encountered. The depth at which said casing shall be cemented and water shut off shall be determined by the Supervisor. After approval of said water shut-off, the well shall be deepened and tested, by 15-foot stages, as hereinbefore specified.

7. In the event that the foregoing specified tests fail to discover the presence of oil-bearing formations, it will be satisfactory to the Supervisor for the company to cement casing at a depth of 3300 feet, as previously proposed.

8. In the event that the foregoing specified tests prove the presence of oil-bearing formations, it will be necessary to permanently maintain

a shut-off of water by cementing a string of casing above said oil-bearing formation.

9. All tests and operations hereinbefore specified shall be witnessed by and approved by the Supervisor, or a representative duly authorized by him. The company shall notify the Supervisor in writing when it is ready to perform said tests and operations. Said notices shall be delivered at such time as to give reasonable notice and allow the Supervisor time to send a representative to the well.

10. All proposals to deviate from the foregoing specifications must be made by the company in writing before said deviation has been accomplished. No proposal shall be considered as approved by the Supervisor unless it is given in writing by the Supervisor, or his duly authorized representative.

11. Deputy Supervisor R. N. Ferguson is hereby duly authorized to receive written proposals from the company, to issue written approval or rejection of said proposals, and to witness all tests and operations hereinbefore specified. Said Deputy Supervisor is also hereby authorized to designate such persons as may be necessary for the purpose of witnessing tests and operations.

Dated: San Francisco, California, April 22, 1918.

R. P. McLAUGHLIN,  
State Oil and Gas Supervisor.

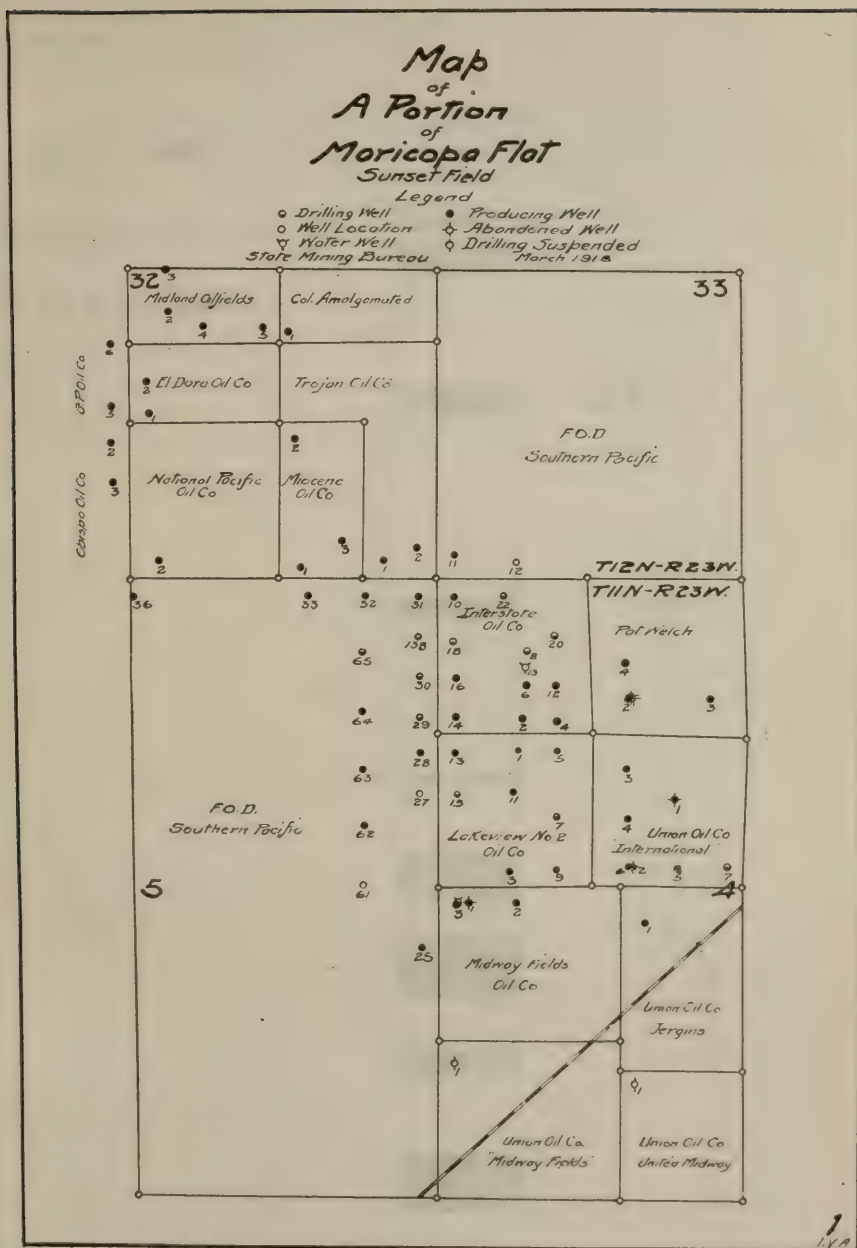


FIG. 15.

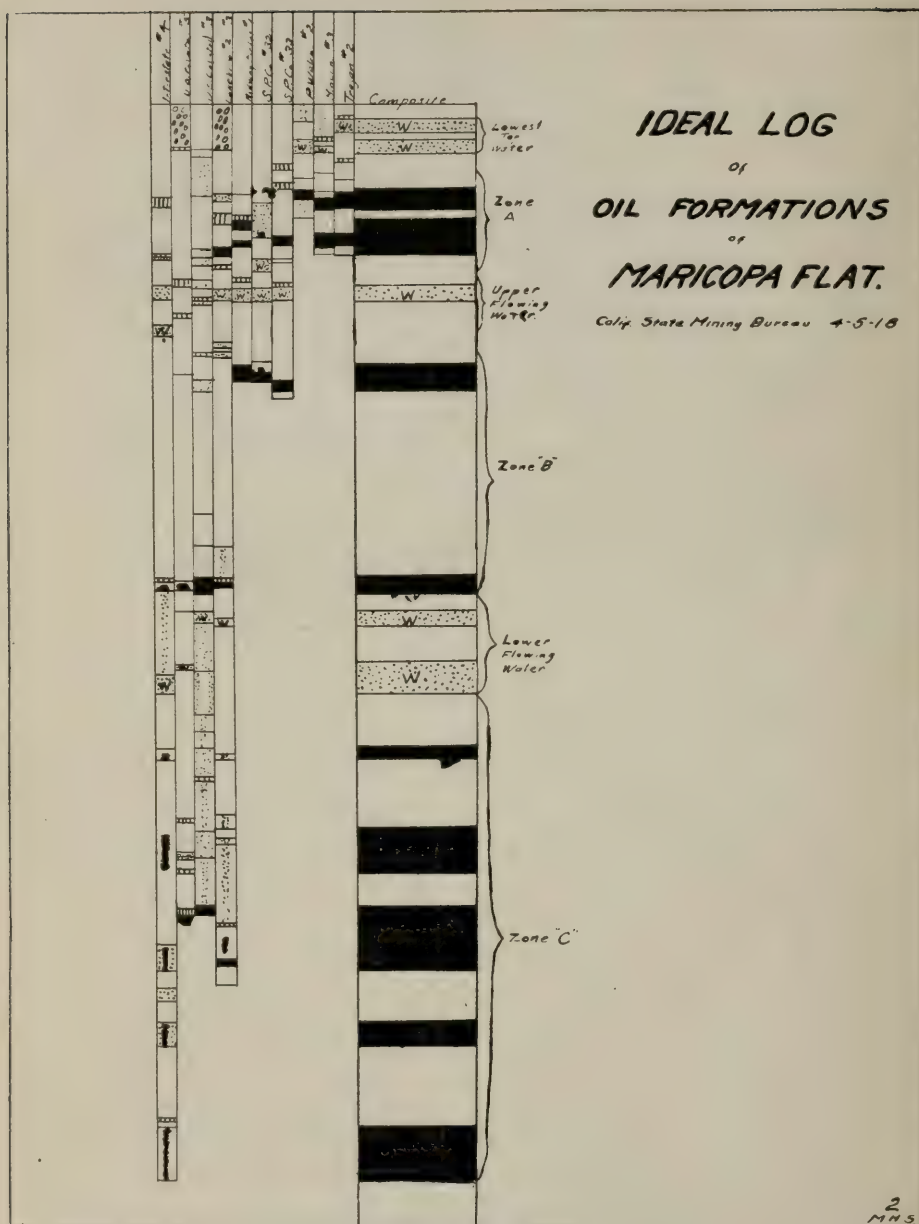


FIG. 16.

*Map  
of  
A portion  
of  
Mojave Flat  
Showing wells which have produced  
or are now producing from  
Zone "A"  
State Mining Bureau March 1918*

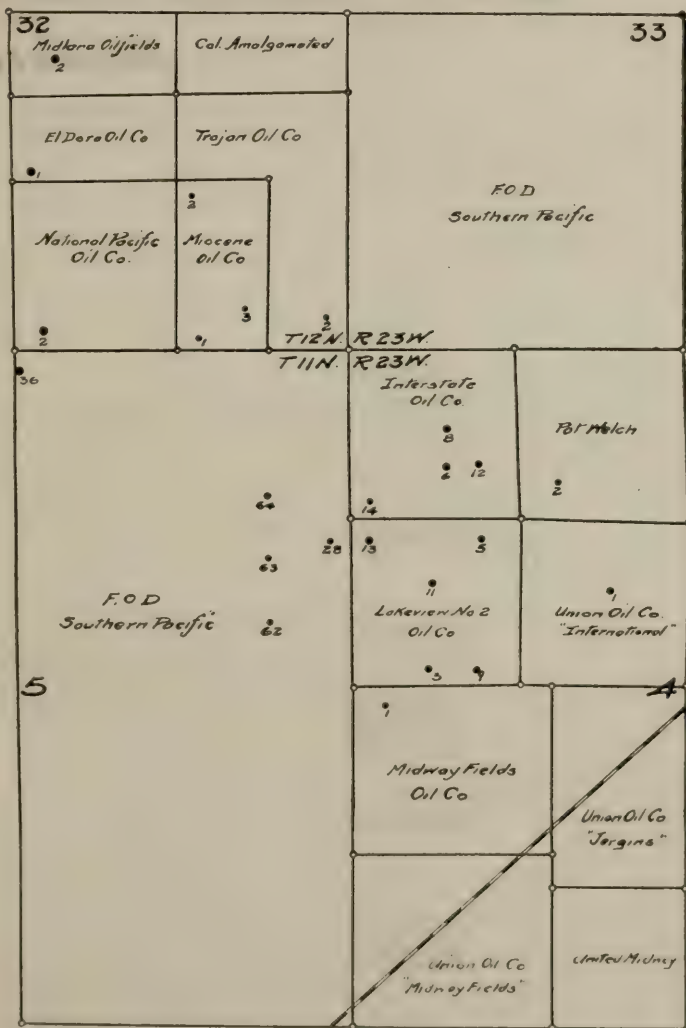


FIG. 17.

TABULATION OF PRODUCTION FIGURES FOR ZONE "A."  
Production to February 1, 1918, in barrels.

Company	Well No.	Section	Township	Range	Date completed	Total oil	Total water	Average per producing day		Average gravity	Thickness of oil sand	Remarks
								Oil	Water			
Southern Pacific	28	5	11N	23W	2/15/18	1,776	14	111	.9	18.9	5'	Prod. for Feb., 1918.
Southern Pacific	36	5	11N	23W	12/14/11	60,461	1,349	74	1.6	21	14'	Production since Oct., 1915.
Southern Pacific	62	5	11N	23W	12/20/17	1,040	2,145	39	79.0	18	6'	New well.
Southern Pacific	63	5	11N	23W	1/31/18	55	0	55	0	19	3'	
Southern Pacific	64	5	11N	23W	9/19/17	9,043	133	93	1.5	19.1	7'	
Interstate Oil Co.	6	4	11N	23W	4/ 3/16	100,568	7,321	161	12.0	21.3	7'	Off production May, 1917.
Interstate Oil Co.	8	4	11N	23W	1/25/17	10,276	3,247	107	34.0		4'	
Interstate Oil Co.	12	4	11N	23W	4/ 4/17	24,804	3,139	93	21.0	21.2	4'	
Interstate Oil Co.	14	4	11N	23W	7/10/17	2,610	1,182	135	6.0	20.1	10'	
Lakeview No. 2	3	4	11N	23W	1/20/14	56,919		140			7'	
Lakeview No. 2	5	4	11N	23W	6/ 5/16	100,485	1,321	169	2.5	21.9	7'	
Lakeview No. 2	9	4	11N	23W	1/14/17	3,192	322	41	4.0		5'	Off production April, 1917.
Lakeview No. 2	11	4	11N	23W	6/ 8/17	7,022	153	38	0.8	21.3	5'	
Lakeview No. 2	13	4	11N	23W	1/15/18	1,278	7	85	0.5	18.0	8'	New well.
Pat Welch	2	4	11N	23W	12/21/17	8,388	1,564	210	39.0	21.0	7'	See history.
Midway Fields	1	4	11N	23W		90,000					5'	See history.
Union "International"	1	4	11N	23W	2/13			75	150.0		4'	
Trojan Oil Co.	2	32	12N	23W	3/ 9/18			225	75.0	17.0	21'	
Midland Oilfields	2	32	12N	23W	8/20/11	270,634	*400,000	336	460.0	23	18'	
National Pacific	2	32	12N	23W	12/ 6/10	2,705		500			12'	
Miocene	1	32	12N	23W	2/27/12	501,214	60,357	250	30.0	19.4	20'	No record of water.
Miocene	2	32	12N	23W	5/14/13	140,848		440		22.0	20'	Production for Feb., 1918.
Miocene	3	32	12N	23W		5,098	1,300	268		18.0	20'	Prod. Mar., 1916-Jan., 1917.
El Dora Oil Co.	1	32	12N	23W	2/ 6/18	34,757	10,463	174	52.0	21.0		No reports.
El Dora Oil Co.	2	32	12N	23W								
Total production Zone A						1,433,173	496,417					

\* Approximately.

† Not through oil sand.

**Map  
of  
A portion  
of  
Maricopa Flat**  
*Showing wells which have produced  
or are now producing from  
Zone B*  
State Mining Bureau      March 1916

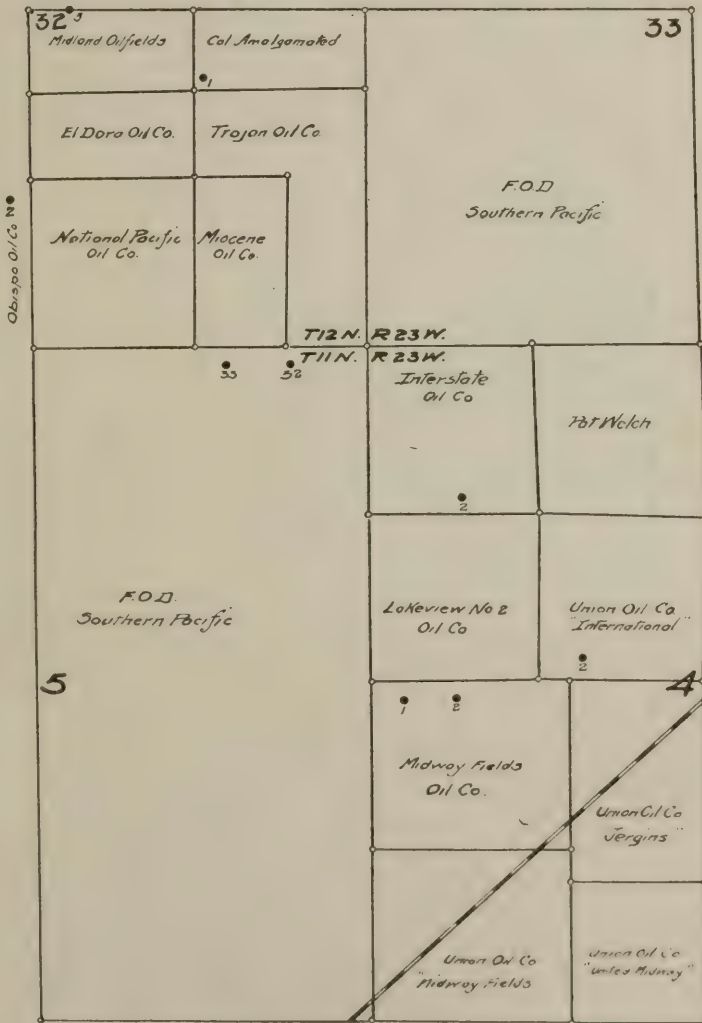


FIG. 18.

TABULATION OF PRODUCTION FIGURES FOR ZONE "B."  
Production to February 1, 1918, in bbls.

Company	Well No.	Section	Township	Range	Date completed	Total oil	Total water	Average per producing day		Average gravity	Thickness of oil sand	Remarks
								Oil	Water			
Interstate Oil	2	4	11N	23W	1/23/13	856,322	66,685	520	40.0	24.0	8'	Report for Sept., 1913, missing. See history. production from "A" and "B."
Union "International"	2	4	11N	23W	2/14	90,000		50	?		15'	
Midway Fields	1	4	11N	23W							13'	
Midway Fields	2	4	11N	23W							*	No report.
Southern Pacific	32	5	11N	23W	1/9/13	144,893	143,632	178	176	24.6	6'	
Southern Pacific	33	5	11N	23W	5/12/13	112,839	13,456	135	16	25.4	5'	
California Amalgamated	1	32	12N	23W								No reports. Nov., 1915, to Mar., 1916; Jan., 1916, missing. Bailed to test, April 14, 1912; mostly all water.
Obispo Oil	2	32	12N	23W	10/19/12	22,796	229	153	1.5	25.9	*	
Midland Oilfields	3	32	12N	23W	7/26/12						12'	
Total production of above wells from Zone B						1,226,850	224,002					

\*Not through oil sand.

*Map  
of  
A portion  
of  
Moricopa Flat  
Showing wells which have produced  
or are now producing from  
Zone C*

State Mining Bureau

March 1918

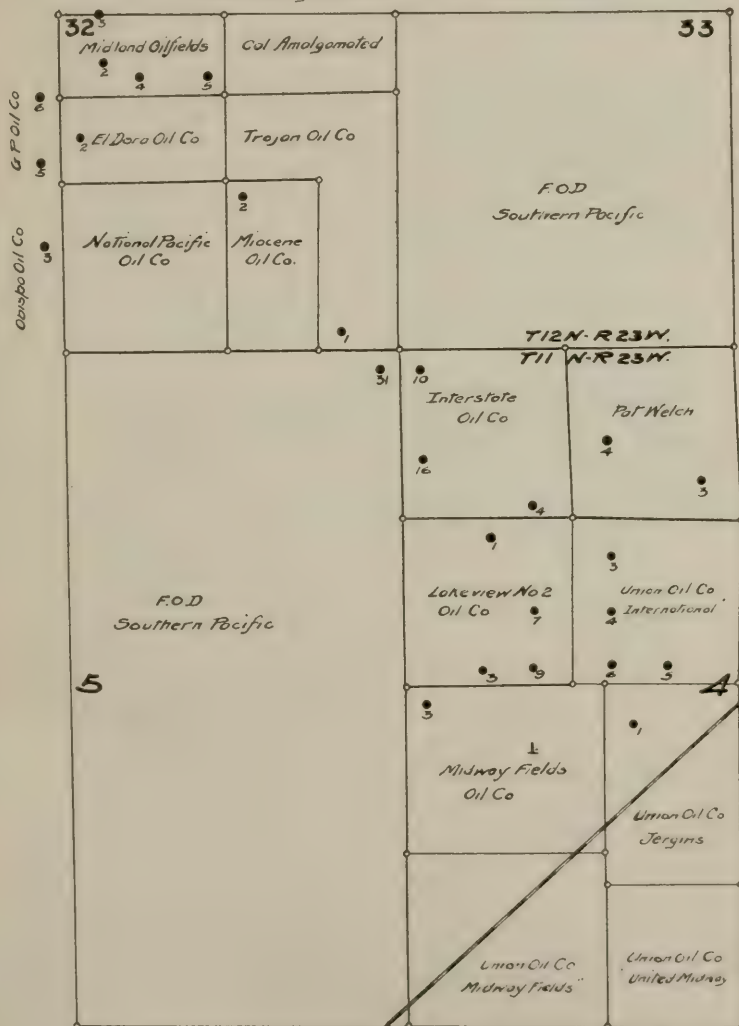


FIG. 19.

TABULATION OF PRODUCTION FIGURES FOR ZONE "C."  
Production to February 1, 1918, in bbls.

Company	Well No.	Section	Township	Range	Date completed	Total oil	Total water	Average per producing day		Average gravity	Thickness of oil sand	Remarks
								Oil	Water			
Interstate	4	4	11N	23W	6/16	488,552	549	793	0.9	27.0	86'	
Interstate	10	4	11N	23W	7/ 5/17	172,753	120	835	0.6	27.0	17'	
Interstate	16	4	11N	23W	1/22/18	1,000	0	240	0	27.0	10'	New well.
Lakeview No. 2	1	4	11N	23W	5/10/14	45,175,000	3	30,000		25.0	*	
Lakeview No. 2	2	4	11N	23W		200	0				38'	
Lakeview No. 2	7	4	11N	23W	11/22/16	80,828	7,498	210	17.0	27.0	6'	
Lakeview No. 2	9	4	11N	23W	11/30/17	100	150	5	7.5	27.0	28'	
Pat Welch	3	4	11N	23W		500	25,000					
Pat Welch	4	4	11N	23W	8/ 1/17	233,657	43,502	1,743	325.0	25.3	14'	
Union "International"	3	4	11N	23W	9/25/15	986,339	204,417	1,230	255.0	24.4	8'	Production since Nov., 1915.
Union "International"	4	4	11N	23W	6/24/16	752,457	64,060	1,370	117.0	25.0	*	
Union "International"	5	4	11N	23W	4/24/17	465,116	71,452	1,723	276.0	24.5	*	
Union "International"	6	4	11N	23W	12/16/17	8,469	4,111	197	95.0	23.8	16'	
Midway Fields	3	4	11N	23W	2/14			700	0.0			See history.
Union "Jergins"	1	4	11N	23W	4/28/15	8,763	2,777	11	3.4	17.5	8'	
Southern Pacific	31	5	11N	23W	8/10/17	14,534	170	121	1.4	26.4	15'	
Midland Oilfields	2	32	12N	23W	5/10/15	87,308	48,395	104	57.5	18.9	13'	Production since Oct., 1915.
Midland Oilfields	3	32	12N	23W	1/ 3/14	5,037	80,527	12	200.0	23.9	18'	Production since Oct., 1915.
Midland Oilfields	4	32	12N	23W	7/12/14	795,039	139,802	1,011	183.0	21.9	35'	Production since Oct., 1915.
Midland Oilfields	5	32	12N	23W	4/ 7/15	6,527	51,634	17	150.0	23.1	71'	Production since Oct., 1915.
General Petroleum	5	32	12N	23W	7/24/12	121,166	880	147	1.1	26.4	18'	Production since Oct., 1915.
General Petroleum	6	32	12N	23W	4/24/13	264,556	1,161	321	1.4	26.3	4'	Production since Oct., 1915.
Obispo	3	32	12N	23W	12/22/13	44,488	4,616	291	30.6	25.7	8'	Production from Nov., 1915, to Mar., 1916, less Jan., 1916.
Miocene	2	32	12N	23W	4/28/14	2,001,492	455,174	1,506	343.0	26.0	15'	Production from Mar., 1916; Jan., 1918, missing.
Trojan	1	32	12N	23W	3/15	452,669	0	675	0	26.7	22'	Well deepened.
El Dora	2	32	12N	23W	3/ 1/18			200	0		30'	
Total production of above wells from Zone C						2,175,530	1,211,995					

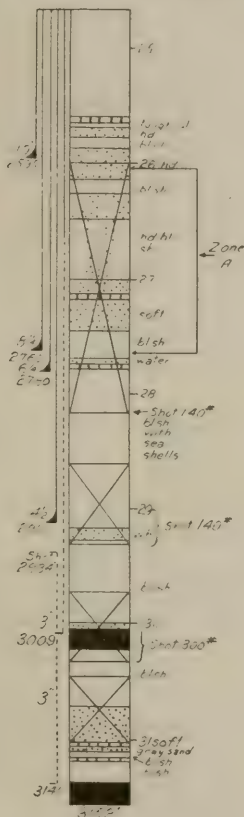
\*Not through oil sand.

†Estimated.

## ABSTRACT OF HISTORY OF PORTION OF

## UNION OIL CO. (International) #2 4" / 23

## WITH COMMENTS



10' Casing cemented at 2595' with 180 sacks. Set 15 days. Drilled to 2611' - bailed hole and water broke in.

Drilled from 2611' to 2695' with Standard tools, water not shut off, and from 2695' to 2760' with rotary. Cemented 8½' at 2760' with 120 sacks. (This was below point where top oil sand might be expected). Drilled to 2765' bailed to 1800 stood 4 hours without showing water.

Drilled to 2780' and cemented 6½' at that depth with 50 sacks. (History gives no reason but it probably was to cement off upper flowing water)

Drilled to 2780', bailed 600' - water broke in.

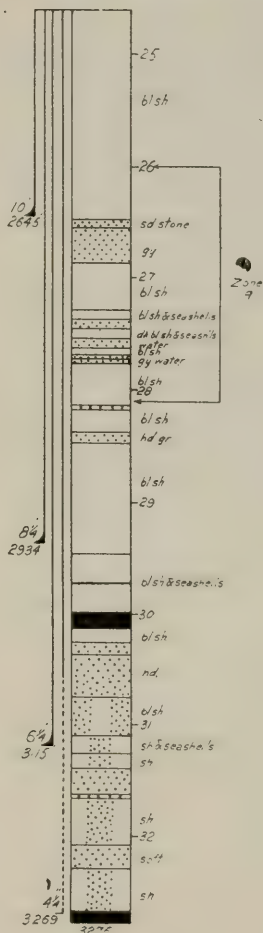
Drilled to 2842' with cable tools and to 2925' with rotary and cemented 4½' on a bridge at 2910' with 55 sacks.

Drilled to 2915', bailed to 2000' and drilled to 2945' with water at 2000.

Carried 3' to 3019', encountering oil at 3004'. Tested this. Produced 10 bbl. daily (This is the Tar Sand of Zone 'B').

FIG. 20

ABSTRACT OF HISTORY OF PORTION OF  
**UNION OIL CO. (International) #3 4" / 23**



WITH COMMENTS

Drilled with rotary to 2666'.  
 Bridged back to 2645' - cemented 10" at  
 2645' with 200 sacks. Drilled to 2666'  
 could not bail water.

Drilled ahead with cable tools  
 to 2934', carry 8 1/2" with water not shut  
 off.

Cemented 8 1/2" at 2934' with 60  
 sacks.

Drilled to 2944' - bailed to 2000  
 found water shut off.

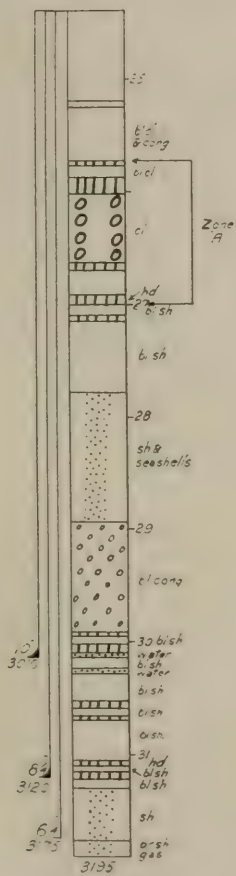
Drilled to 3015' with cable tools.  
 tested showing at 3000'.

(This was the Tar Sand of Zone B')  
 Carried 6 1/2" to 3028' encountering  
 water sand. (Lower flowing water)

FIG. 21.

ABSTRACT OF PORTION OF HISTORY OF  
**UNION OIL CO.** (International)

4 4 <sup>11</sup>/<sub>23</sub>



## WITH COMMENTS

January 1st, 1916 began  
drilling with rotary.

February 20th 1916 cemented  
10' casing at 3010', using 300 sacks  
of cement.

(This was through all shallow production and just above lower flowing water).

FIG. 22.

ABSTRACT OF HISTORY OF PORTION OF  
**UNION OIL CO. (International) #5 4" / 23**

WITH COMMENTS.

August 22nd 1916 began  
 drilling.

October 14th 1916, cemented  
 10' casing at 3015', using 400 sacks.

This is through all shallow  
 productive sands.

At 3055 Ter sand of  
 Zone 'B' was encountered.

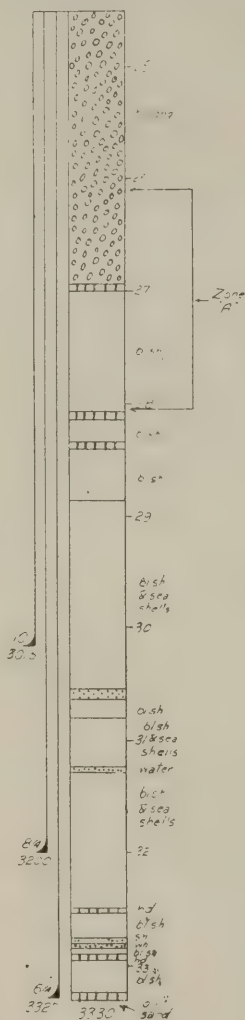


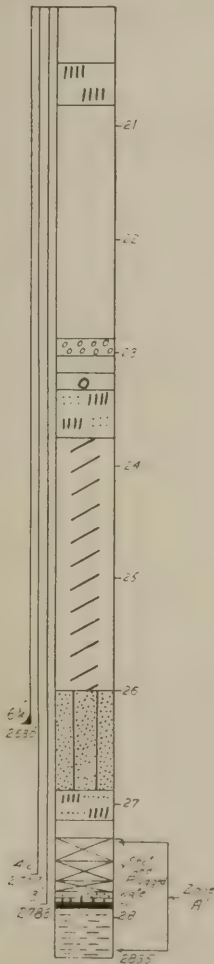
FIG. 23.





ABSTRACT OF HISTORY OF PORTION OF  
**UNION OIL CO. (International) #1 4" / 23**

WITH COMMENTS.



Taken over from Coronation by Union Oil Co. at a depth of 2835' with 4" oil string to that depth. 6 1/2" casing parted at 800' and water in the hole. 9 joints tubing lost in hole.

Pulled 800' of 6 1/2", recovered 6 joints of tubing, shot 4 1/2" at 2740' and pulled. Found shoe of 6 1/2" at 2630'. Screwed 6 1/2" together tight, - plugged hole, bailed 6 1/2" to 500' and water broke in, bringing oil with it.

Sidetracked old 4 1/2" to 2757' and cemented new 4 1/2" at 2757' with 30 racks.

Drilled to 2768', bailed to 1600' showed oil and gas - no water.

Drilled to 2783' and could not bail water below 400'.

Drilled to 2785' and swabed. Well flowed oil and water; about 75 bbl. oil and 150 bbl. water for several months.

Later blown with air, producing about 75 bbl. of oil.

This production came from Zone 'A'. The water probably came from the white sand above Zone 'A'.

FIG. 26.

## TABULATION SHOWING THICKNESS AND

Company	Well No.	Section	Township	Range	Lowest top water sand			Formations from top water to first sand of Zone "A"	
					Thick.	Water level below surface	Volume	Thick.	Nature
Miocene Oil .....	1	32	12	23	8	-----	-----	31	7' shell, 21' blue shale, 4' black shale.
Miocene Oil .....	2	32	12	23	5	-----	-----	40	Sticky blue clay, black shale, brittle shale.
Miocene Oil .....	3	32	12	23	5	-----	-----	37	Sticky blue clay, blue shale.
Trojan Oil .....	2	32	12	23	10	-----	-----	49	Sticky blue shale, shell
P. Welch Oil .....	2	4	11	23	8	173	Not given	31	Sticky blue clay, blue shale.
S. P. Co. (F. O. D.) ..	33	5	11	23	5	-----	-----	150	Blue shale, 3' shells, brown shale.
Lakeview No. 2 Oil..	3	4	11	23	-----	-----	-----	-----	-----
Lakeview No. 2 Oil..	7	4	11	23	-----	-----	-----	-----	-----
Lakeview No. 2 Oil..	13	4	11	23	5	-----	-----	-----	Black shale, hard blue shale.
Midway Fields Oil..	1	4	11	23	-----	-----	-----	-----	-----

## NATURE OF FORMATIONS IN WELLS.

Zone "A"		Formations between Zone "A" and upper flowing water		Upper flowing water			
Thick- -----	Nature	Thick- -----	Nature	Thick- -----	Water level -----	Volume- -----	Nature
63	White sand carrying oil, blue shale, shell, black shale, oil sand.						
30	Oil sand, shale, oil sand	47	Blue shale	3			Water sand, carries some oil and gas.
40	Oil sands with shale between.						
44	Oil sands with shale between.						
25	Oil sand, blue shale and sea shells.						
5	Sand, first logged as water and later as oil.	37	Blue shale, shell	8	Flows	Flows over casing	Sand.
7	3' blue shale, shows oil; 4' oil sand.	27	25' blue shale, 2' shell.	8			Gray water sand.
6	Oil sand	50	46' dark shale, 1' shell.	3			Sand.
10	2' sandy oil shale, 8' hard oil sand.						
19	Oil sands with shale between.	37	33' blue shale, 4' shell.		Flows	Flows	Bluish white sand.

## CASING USED IN WELLS IN WHICH IT WAS

Section	Township	Range	Company	Wells definitely locating Zone "A" before drilling to Zone "C"						
				Casing in feet						
				Well No.	15½"	10"	8½"	6½"	4½"	3"
4	11	23	Union Oil (Intern't'l)	-----	-----	-----	-----	-----	-----	-----
4	11	23	Union Oil (Intern't'l)	-----	-----	-----	-----	-----	-----	-----
4	11	23	Union Oil (Intern't'l)	-----	-----	-----	-----	-----	-----	-----
4	11	23	Union Oil (Intern't'l)	-----	-----	-----	-----	-----	-----	-----
4	11	23	Union Oil (Intern't'l)	-----	-----	-----	-----	-----	-----	-----
4	11	23	Union Oil (Intern't'l)	-----	-----	-----	-----	-----	-----	-----
4	11	23	Union Oil (Jergins)	-----	-----	-----	-----	-----	-----	-----
4	11	23	Lakeview No. 2 Oil	3	-----	2,527	2,578	3,021	3,081	3,258
4	11	23	Lakeview No. 2 Oil	7	120	2,564	2,605	2,964	3,000	-----
4	11	23	Lakeview No. 2 Oil	9	120	2,585	2,629	3,005	3,291	-----
4	11	23	Interstate Oil	16	95	2,408	2,832	2,963	-----	-----
4	11	23	Interstate Oil	-----	-----	-----	-----	-----	-----	-----
4	11	23	Pat Welch	-----	-----	-----	-----	-----	-----	-----
4	11	23	Pat Welch	-----	-----	-----	-----	-----	-----	-----
4	11	23	Midway Fields Oil	3	-----	2,600	2,749	2,752	3,185	-----
5	11	23	S. P. Co. (F. O. D.)	-----	-----	-----	-----	-----	-----	-----
Total casing, in feet				-----	335	12,684	13,393	14,705	12,557	3,258
Cost per foot				-----	\$6.08	\$3.05	\$2.20	\$1.70	\$1.16	\$0.52
Cost by sizes				-----	\$2,037	\$38,686	\$29,465	\$24,999	\$14,566	\$1,694
Total casing cost				-----						\$111,447
Average casing cost per well				-----						22,289

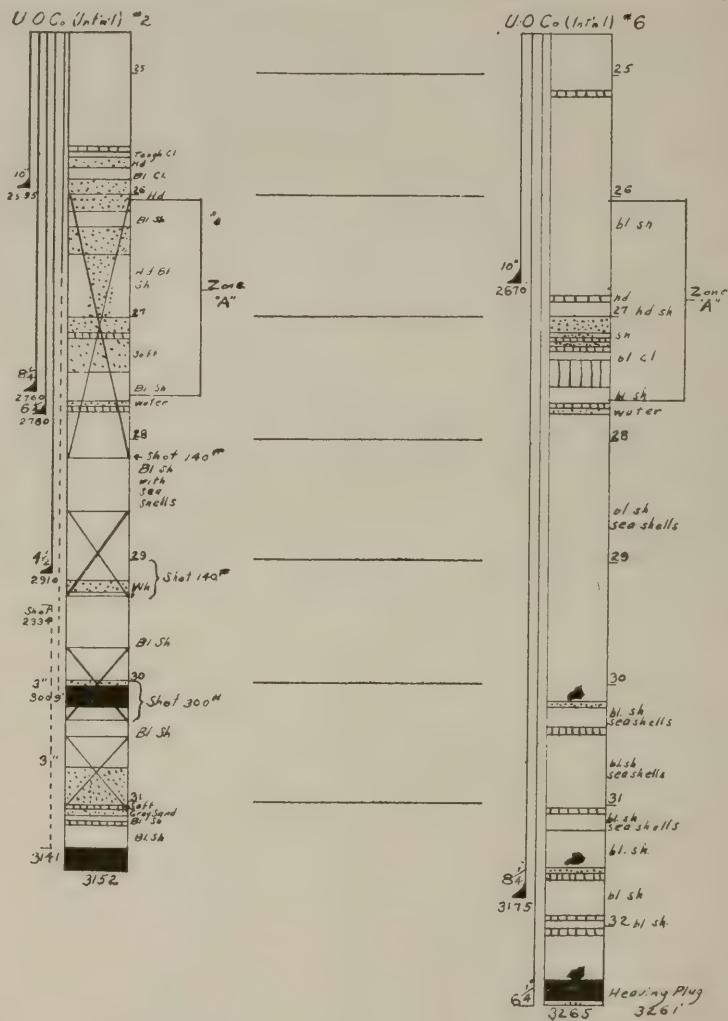
## ATTEMPTED TO PRODUCE FROM ZONE "C."

Wells not definitely locating Zone "A" before drilling to Zone "C"

Well No.	Casing in feet							
	17½" S. P.	15½"	11½"	10"	8½"	6½"	4½"	3"
2	112			2,595	2,760	2,780	2,910	3,147
3				2,645	2,934	3,115	3,269	
4				3,010	3,120	3,175		
5				3,015	3,200	3,327		
6				2,670	3,175	3,265		
1	330			2,720	3,000	3,314	437	
1		185		2,225	2,680	3,005		
4					2,526	3,011	3,387	
10		117		2,604	2,948	2,977	3,131	
3		310		2,979	3,367	3,900		
4		530		2,908	3,234	3,409		
31	(20-18) 277		2,545		2,850	3,073		
	719	1,142	2,545	27,371	35,794	38,351	13,131	3,147
	\$7.50	\$6.08	\$3.06	\$3.05	\$2.20	\$1.70	\$1.16	\$0.52
	\$5,393	\$6,943	\$7,788	\$83,481	\$78,747	\$65,197	\$15,235	\$1,636

Total casing cost..... \$264,420.00  
 Average casing cost per well..... 22,035.00

Comparison of formation logs of two wells drilled about 20 feet apart.



The following operations are cited in the sixth paragraph, Order No. 5, page 414, as illustrating the difficulty of protecting Zone A with mud and cement seal when upper water is not shut off:

**Pat Welch Well No. 4, Sec. 4, T. 11 N., R. 23 W., S. B. B. & M.**

March 6, 1917—10" casing cemented at 2904' with 400 sacks cement. The cement apparently satisfactorily placed. 10" casing tested, and water found not shut off.

April 12, 1917—Pumped about 10 sacks of cement into formation at shoe of 10" casing, under 600 lbs. per square inch pressure.

April 20, 1917—Tested, and found water not shut off.

May 7, 1917—Ripped hole in 10" casing at a depth of 2824' and bailed to 1200', and on May 8, 1917, found water at original level and 100' of fine sand in the hole.

May 12, 1917—Pumped cement into rip after pumping about 500 bbls. of mud into formation through the rip. Final pressure 600 lbs. per square inch. Ripped hole in 10" casing at 2798' (opposite supposed upper oil sand. Attempted to pump water out through rip at 2798' but failed. Assumed that cement had protected top sand and proceeded to drill well into Zone "C."

The next larger string of casing in this well was landed at a depth of 530' and the only other methods that might have been followed to insure protection to the top sand, would have involved either drilling out through the 10" casing with 8" casing above the upper sands, or re-drilling with 10" casing from a depth of about 530'.

**Southern Pacific Company (Fuel Oil Dept.) Well No. 31, Sec. 5, T. 11 N., R. 23 W.**

March 24, 1917—Cemented 11½" casing at a depth of 2545' with 7 tons. Cementing approved as satisfactory. When tested, water found not shut off.

June 30, 1917—Ripped holes in 11½" casing at 2505', 2510' and 2530', but could not pump water through these rips. Assumed that upper sands were sealed and protected by the cement, and proceeded to drill well to zone "C."

The next larger string of casing in this well was landed at a depth of 190'. As in the preceding case, the only other method which might have been used to insure protection to the upper sands, would have involved either re-drilling the hole with the same size casing from a depth of approximately 190' or reducing the size of the hole to 9½" by drilling out through the 11½" casing, above the point where the top oil sand was encountered.

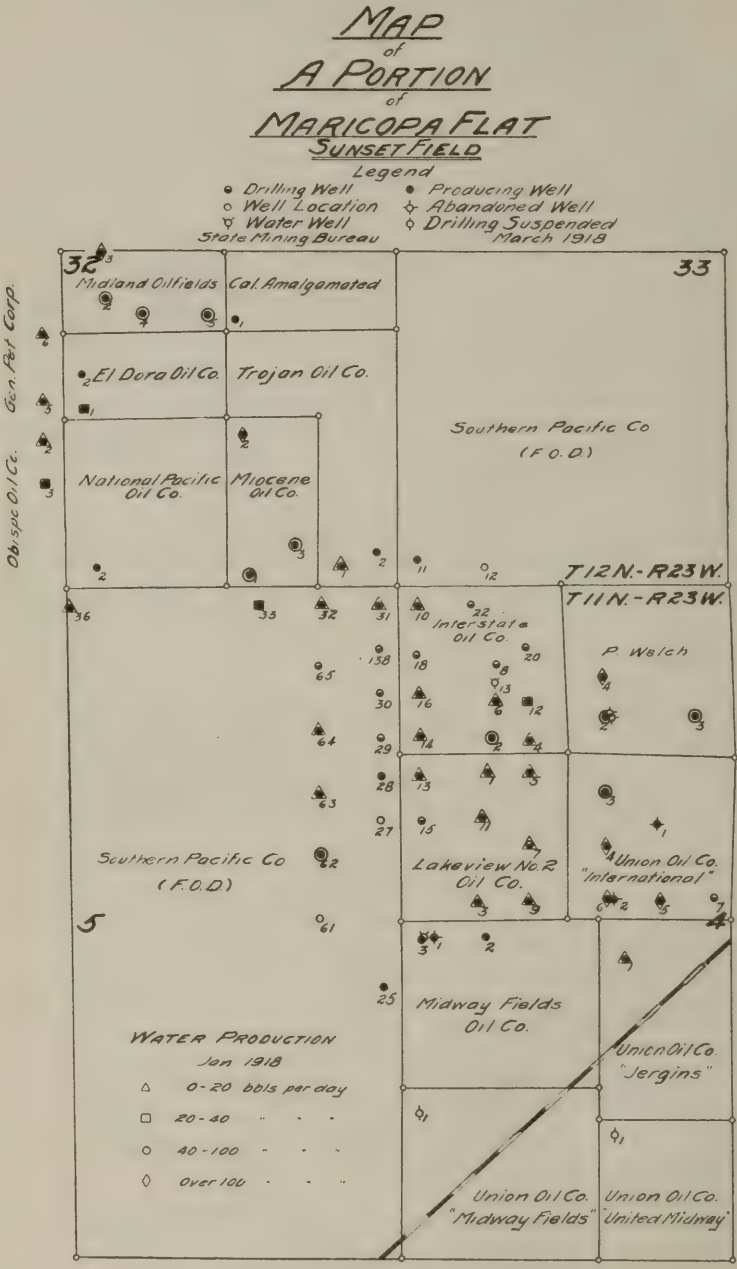


FIG. 28.

## ORDER BY DISTRICT OIL AND GAS COMMISSIONERS.

May 4, 1918.

*In the Matter of the Appeal of the Union Oil Co. to the Oil and Gas Commissioners of the State of California.*

At a meeting held in Taft, California, on April 9, 1918, in reference to the proper completion of Well No. 7 on Section 4/11/23, owned by the Union Oil Co. of California, at which meeting the Oil and Gas Commissioners of the Fourth District of the State of California were invited to attend for the purpose of hearing the evidence given by the California State Mining Bureau, which was represented by R. P. McLaughlin, Supervisor, and his deputies from the various districts of the State of California.

Also evidence given by the Union Oil Co. of California which was represented by G. Kameron, superintendent in this District and various employees, also evidence given by the Lake View No. 2 and Interstate Oil Companies, of this District, which was represented by Mr. Roy Evans, their superintendent and various employees; also evidence given by the Pat Welch Oil Co. of this District, which was represented by Mr. R. R. Pollack, its superintendent.

On the twenty-seventh day of April a hearing was held on appeal to the Oil and Gas Commissioners and said appeal having been taken by the Union Oil Co. from the order made after the hearing on the ninth day of April, 1918, by R. P. McLaughlin, Supervisor of the California State Mining Bureau, and we, the Commissioners to whom said appeal was taken, hereby make the following findings and order in said matter.

1. That the above companies now own and are operating wells located in the northeast quarter of Section 4/11/23.

2. Also to witnesses not directly connected with the above companies.

3. After hearing the evidence and the explanations of the Peg model by Mr. R. N. Ferguson, Deputy Supervisor of this District, in connection with the different methods of drilling by the different companies, also to the method of cementing and mudding off water and oil sands, which in certain depths, lie in close proximity, from the difficulty these different oil companies encountered in drilling wells in this locality.

4. Also, taking into consideration the gravity of the situation as regards making recommendations for the drilling of wells in this or any other locality, to protect all oil sands from the infiltration of water, which, is very essential to the producing of oil in this immediate locality or in any other locality.

5. From the evidence given by the different witnesses, they have adopted, what we would consider, a very good plan of mudding and cementing all oil or water sands encountered or which might be encountered.

6. From the evidence given by the different witnesses during this hearing, on quite a number of occasions, there has been oil sands encountered and either pumped dry or became infiltrated with water. These wells have been deepened by permission from the State Mining Bureau of California, to proceed to a deeper sand which underlies the first oil sand.

7. From the description of the sands by the State Mining Bureau of California, these sands are described as Zone A or first oil sand, Zone B or second oil sand and Zone C or third oil sand.

8. The Lake View No. 2 and Interstate Oil Companies have had some very productive wells from the first zone or first oil sand.

9. From the evidence of the various witnesses, directly under the first oil sand, is what they call a flowing water, which, if encountered and not shut off, would practically ruin the first oil zone.

10. From the evidence taken at this hearing, there was a meeting called some time ago in the S. P. Company's (Fuel Oil Dept.) Office at Kerto, by the different oil companies located in the N.E.  $\frac{1}{4}$  of Section 4 11/23. At this meeting, there was also a representative of the California State Mining Bureau.

11. They took up the matter of the best method to pursue after deepening wells from the first oil zone to a deeper zone. They finally decided that they could land another string of casing about 400 or 450 feet below the first oil zone and force enough cement behind this casing to extend through the upper oil zone. Also, through the flowing water encountered directly below this oil zone, sealing off all oil and water encountered above the lower casing shoe which would be approximately 400 feet.

12. From the evidence taken at this hearing it would appear that it was necessary to have a string of casing landed in close proximity to Zone A or first oil sand to tie to when making the next cement job. After commissioners have deliberated on the evidence for some time it was decided that a string of casing landed in close proximity to Zone A or first oil sand was a very good idea but on the other hand did not deem it necessary to make a good cement job and decided they would rather have enough room between the first oil zone and casing landed above first oil zone to pump enough cement to cover any oil sands below casing shoe to protect sands from infiltration of water but not have cement to come in contact with casing above Zone A or first oil sand.

13. From the evidence given at this hearing it was very clearly defined that this process which they had adopted, of cementing, had proven very effective due to the tests of oil made for water produced from the various wells before and after these various wells were drilled to a lower zone.

14. From the evidence given at this hearing by the different witnesses, the water infiltration into Zone A oil sand from any water encountered while drilling below Zone A or first oil sand, was really nothing more than could be expected from the oil produced in the period of time which intervened between the time the first oil sand was encountered and the drilling and producing oil from Zones B or C. Therefore, we think, that the amount of cement these wells were cemented with had effected a very good seal to any and all water encountered below the first oil sand. Also, it must be remembered that the wells that were drilled to a lower depth, either Zone B or C, were not being produced from Zone A.

15. The International Oil Company of California have drilled several wells on their parcel of land in the N.E.  $\frac{1}{4}$  of Section 4/11/23, and from the evidence given at this hearing, the Union Oil Company of California had purchased this land on the strength of a well drilled on this parcel of land, known as Coronation No. 1.

16. At the time this purchase was made, this well was flowing some oil and water. The Union Oil Company started their development work shortly after purchasing this property, and from the evidence given at this hearing, expended in the neighborhood of \$214,000.00 trying to locate Zone A or the first oil sand, which the Interstate and Lake View No. 2 and Pat Welch Oil Companies were producing from. After repeated effort to locate this sand, they finally decided to abandon the idea of ever locating an oil sand known as Zone A. And, from the recommendations by them to the California State Mining Bureau, they were allowed to proceed to deepen these wells to a depth sufficient to satisfy them whether there was a lower Zone or Zones, which, they afterward discovered to be known as Zone B and C in that locality. Several wells were drilled which proved very productive.

17. From the evidence given at this hearing, the Union Oil Company, before landing what they called a water string at a depth of approximately 3000 feet, did mud up and pump in enough cement behind this string of casing to seal off all water and oil if any were encountered, far enough back above Zone A to protect oil sands operated and produced by any other companies on the N.E.  $\frac{1}{4}$  of Section 4/11/23.

18. From the evidence given at this hearing, it would appear to us that this has been very effectually done, due to the small increase of water from the first oil zone or zones during a period of several years.

19. The Union Oil Company's Section 4/11/23 well No. 7 was drilled to a depth of 2840 feet with a 16" rotary bit from top of hole to bottom. While this company was putting in their 10" casing, this casing became tight at 2570 feet; so tight, that this casing could not be loosened after making repeated attempts. They afterward tried for

circulation behind this casing, which they got, and pumped in 150 sacks of cement. After leaving hole stand cemented for a certain length of time, they tested out this well for water.

20. After cleaning out this well through the shoe and testing for water, they found they could not lower water below the water level. They decided they had either encountered water below the casing after this well had been drilled 2840 feet, but casing was landed and cemented at 2570 feet, or water was coming around the 10-inch shoe.

21. The Union Oil Company requested permission from the California State Mining Bureau to proceed with this well to a depth of 3300 feet with 8 $\frac{1}{4}$ -inch casing. Before casing was landed at 3300 feet, they were to pump enough cement behind this string of casing to come back far enough or to the bottom of the 10" casing, which was landed at 2570 feet and to cement off all water sands that had been encountered below that depth. This request was refused by the State Mining Bureau. The Union Oil Co. then requested permission to land a string of 6 $\frac{1}{4}$ -inch casing at 2840 feet, cementing same. After cement had set long enough, to guarantee its hardness, they were to make proper tests witnessed by the State Mining Bureau of California as to its virtue. After the State Mining Bureau had accepted same as dry, they were to proceed with the drilling of this well to a depth deep enough to determine if Zone A extended through the property or to this well. This proposal was also rejected by the State Mining Bureau.

22. We, as a body of Commissioners, who represent the Oil Industry of the Fourth District of the State of California thought that test referred to in paragraph 21, would have been a very good test to determine for all times whether Zone A extended to this property in paying quantities, as the Union Oil Company had endeavored for several years prior to this time to develop this Zone A or first oil sand.

23. After the Commissioners of the Fourth District of the State of California had heard the evidence given in reference to the drilling of wells which had been drilled and produced from Zone A or first oil sand, also had been drilled through Zone A and produced from the lower Zones and the proper methods had been pursued whereby the top Zone was protected from water by the mudding and cementing process, we, the Commissioners of the Fourth District of the State of California, have agreed that the drilling of Section 4/11/23 Well No. 7 on the N.E.  $\frac{1}{4}$  of this section, should be drilled to a depth of 3300 feet, using 8 $\frac{1}{4}$ -inch casing, and that enough cement should be pumped behind this string of 8 $\frac{1}{4}$ -inch casing to reach to a height of not less than 2700 feet, and that after this cement has been pumped in the hole of a sufficient quantity, that cement is followed up with mud of a sufficient weight to

approximately counterbalance the weight of the cement so that after the casing is landed at 3300 feet, no cement could force its way back into the casing. This, we, the Commissioners of the Fourth District of the State of California, think would make a very practical and good cement job, to protect any and all oil sands, if such oil sands exist between the depth of 2570 feet where 10" casing is landed and 2875 feet where oil sand, if any, might be encountered.

24. This well No. 7, at the present time, has a hole drilled to 2840 feet by a 16" rotary bit, leaving a hole below the bottom of the 10" casing, which is landed at 2570 feet, of 270 feet, which is 16" in diameter. From this depth to a depth of 3300 feet this hole should be drilled with a 10" rotary bit.

25. From the order issued from the Mining Bureau wherein they recommend the International Oil Company to develop this well from 2840 feet, after 6 $\frac{1}{4}$ " casing is cemented at that depth, they suggest the drilling of 15 feet at a time and testing for oil and water, and continuing this test by drilling 15 feet at a time, until oil or water is encountered. This is unsatisfactory.

26. After the commission had deliberated on this order for some time and the commissioners all being practical men they decided that this method would be impracticable and almost impossible to keep casing free and make these tests every 15 feet.

*Therefore*, we the commissioners of the Fourth District hereby order that the Union Oil Company, or International Oil Company, drill said hole to a depth of 3300 feet using 8 $\frac{1}{4}$ " casing and pump sufficient cement behind this string of 8 $\frac{1}{4}$ " casing to reach a height of not less than 2700 feet and that after this cement has been pumped in the hole that they follow up with mud of sufficient weight to counterbalance the weight of the cement so that after the casing is landed at 3300 feet no cement could force its way into the casing. This method was testified to by Mr. Evans of the Lake View No. 2 Oil Company and Mr. Pollack of the Pat Welch Oil Company, to be practical and very satisfactory.

It is further ordered that the Union Oil Company shall mud off all sands as encountered under pressure of 400 pounds per square inch at the surface, or to such times as the sands shall take no more mud, to a depth of 3300 feet or at the point casing is to be landed.

It is also ordered that at the time the cementing is to be done, that the Union Oil Company notify the Deputy Supervisor so that a representative of the State Mining Bureau and a representative of the Oil and Gas Commissioners of the State of California, be present and that in the event of any mechanical failure during the pumping of this mud and cement, whereby a sufficient amount of cement can not be pumped

behind this casing to seal off all the sands encountered below the depth of 2570 feet, the matter to be taken up immediately with the oil and gas commission for its consideration.

Dated this 4th day of May, 1918.

E. J. SCHNEIDER,  
C. E. BALLAGH,  
J. B. NEWTON,  
PERCY A. WILLIAMS,  
D. T. SAINÉ,

Board of Commissioners.

NOTE.—January 1, 1919. Three months after completion of the well, in a manner disapproved by the engineering staff of the State Mining Bureau, it is producing considerable water and has actually depreciated the value of the entire property. The total production of the property during three months prior to completion of the well was 136,840 bbl. of oil, while during an equal period of time since its completion the total oil production has only been 112,684 bbl.

### SUNSET FIELD.

The extent of this field has been somewhat enlarged by the development of production by the Standard Oil Company on Section 7, T. 11 N., R. 23 W., S. B. B. & M., and the Midway Oil Company on Section 35, T. 12 N., R. 24 W., S. B. B. & M.

Peg models on a scale of 100' to the inch, both vertical and horizontal, have been constructed covering a portion of the Maricopa Flat and as a result the information on this area is much more exact than it was previously.

A contour map of the first oil sand of Zone A has been prepared and has proved invaluable in determining the proper point of shut-off in new wells.

The composite log (p. 424), made up by combining some typical logs graphically, has been used with excellent results in predicting the depths of the various sands below the top of the first oil zone.

### BELRIDGE FIELD.

Careful operations in this field by the General Petroleum Corporation and the Marina Oil Company have successfully overcome a very difficult water situation and have developed a good production from shallow depth. The method used by these companies of thoroughly testing the formations penetrated, as the hole is drilled, are worthy of emulation by many other operators. In this testing much use is made of a temporary shut-off above the sand to be tested.

### KERN RIVER FIELD.

The year has not been marked by any great improvement in water conditions in the field.

Several companies in the vicinity of the old West Shore property in Section 32, T. 28 S., R. 28 E., M. D. B. & M., have by mutual agreement

persistently sought for an offending well in the hope that by plugging it their water troubles would be eliminated. At the end of the year the work has not shown any results after several wells have been tested. Commendable as this spirit of co-operation is, it is believed that much time and money might have been saved by a thorough investigation of the early records as well as of the underground structure before the work was begun. Such an investigation is being made or has recently been completed by the geological department of the Standard Oil Company and there is little room for doubt that if the recommendations of the investigating engineers are followed the source of the water will soon be apparent.

The Associated Oil Company has begun an extensive engineering investigation that will undoubtedly yield big returns. To date no repair work complying with the recommendations of the engineer has been begun, but we are informed that such work is to commence shortly.

#### **Investigations.**

Investigations by this department have not reached completion during the year, but the following work is under way:

In Kern River field a cross section was made by the department along the line between the Associated (Kern) and the Peerless Oil Company properties showing line wells of both companies. Prints of the cross section were furnished both companies for their use in connection with a proposed campaign to shut off water.

A peg model of the N.W.  $\frac{1}{4}$  of Section 31, T. 28 S., R. 28 E., M. D. B. & M., was constructed, but no further work has been done towards completing the investigation of that area.

A further investigation of conditions in the vicinity of the Amaurot and Del Rey Oil Companies property in Section 5, T. 29 S., R. 28 E., M. D. B. & M., was undertaken and brought nearly to completion, but work on it had to be suspended. In this investigation a peg model and complete cross sections were constructed, all based on a stadia survey of the property made by this department. An extensive study of the available records of the wells involved was also made and it is expected that it will be possible to issue a report by the first of the year.

#### **MIDWAY FIELD.**

On page 261, Bulletin No. 82, a proposed investigation of the Twenty-five Hill area was announced. Since that time a peg model has been constructed of Sections 25 and 26 and portions of 22, 23, and 24, T. 32 S., R. 23 E., M. D. B. & M., and a close study of all available records of all wells on Sections 25 and 26 has been made. A complete report on the last two sections will be issued as soon as possible.

**Sections 25 and 26, T. 31 S., R. 22 E., M. D. B. & M.**

The fact that operations were being carried on in this vicinity with no regard for uniformity in depth of shut-off has been recognized by this department for some time. The suggestions of the department as to establishing greater uniformity did not meet with universal favor and it was necessary to compile all available data to bring out the facts. Peg models have been completed of 1280 acres in this vicinity and the resulting information is such now that a great deal of assistance can be given the operators in the vicinity.

**Requests for Investigations.**

Requests have been made by owners and operators for investigations in the following cases:

Under date of January 7, 1918, a request was made by the following operators for an investigation of the water conditions in the vicinity of their properties in the McKittrick field.

Claude Pearson  
J. H. Crafts  
J. A. Pickle  
Roy Fry  
P. E. Bowles, Jr.

East Puente Oil Co.  
Berry & Keller Oil Co.  
Jewett Oil Co.  
S. P. Co., Fuel Oil Dept.  
Reward Oil Co.

A previous preliminary examination of the records of the area had shown that the records filed were insufficient for the purpose. To make this investigation it will first be necessary for the Department to go out and gather the necessary logs. It will also be necessary to make a property survey in order to get sufficiently accurate information from which to construct peg models and cross sections. Owing to the fact that a number of investigations having priority over this request have not yet been completed, this one has not yet been acted upon.

On May 9, 1918, the State Oil and Gas Supervisor instructed the deputy to start an investigation of the water conditions existing in Section 16, T. 32 S., R. 24 E., M. D. B. & M. A property survey was made of this section and some surrounding territory and a peg model was constructed. As a result of this work the department has been able to make a contour map of the first gas sand throughout a portion of the Buena Vista Hills which has shown some quite unexpected structure. The development of production from this gas sand in Midway Gas Company, Well No. 69, Section 15, T. 32 S., R. 24 E., M. D. B. & M., has led to the discussion of the advisability of shutting upper water off above this zone in all new wells.

A conference of operators was held at the office of the State Mining Bureau after the close of the year to consider the subject. At this conference it was decided that the deputy should outline the area within which it appeared advisable to make the shallow shut-off uni-

form. The investigation on which this is to be based is not yet completed.

On March 28, 1918, the State Oil and Gas Supervisor requested the various companies operating in the vicinity of Section 14, T. 32 S., R. 23 E., M. D. B. & M., to outline their knowledge as to the underground structure in that vicinity and to submit to him a statement as to their desires in the matter of protecting certain shallow oil sands in future drilling. We understand that the companies are co-operating in this investigation and that a report is to be submitted within a few months.

### Complaints.

Under date of January 12, 1918, the Sunbeam Oil Company, operating in Section 52, T. 29 S., R. 21 E., M. D. B. & M., made complaint against the United Western Consolidated. Owing to the great amount of unfinished work before the department the investigation requested has not yet been undertaken.

On January 31, 1918, complaint was made by Howard M. Payne, Receiver for the Recovery Oil Company, Section 25, T. 31 S., R. 22 E., M. D. B. & M., against the Visalia Midway Oil Co., in the same section. The particular well complained of was No. 6. Peg models of the area in question have been constructed and the investigation has been begun.

## DECISIONS.

### NORTH LOST HILLS.

T. 25 S., R. 19 E., M.D.B. & M.

#### SECTION 2.

Crescent Petroleum Co.

Well No. 1, abandon. P 4-609.

Proposal to abandon received and later canceled because of company's change in plans.

Well No. 1, redrill. P 4-898.

Proposal to redrill approved with understanding that this department be informed as to developments.

Well No. 1, abandon. P 4-1308.

Proposal to abandon answered with complete specifications for carrying out the work.

Well No. 1, abandon. P 4-1427.

Proposal to abandon approved, as submitted by the owners, following recommendations issued by this department in Report No. P 4-1308.

### DEVIL'S DEN FIELD.

T. 25 S., R. 18 E., M.D.B. & M.

#### SECTION 32.

Devils Den Consolidated Oil Co.

Well No. 1, abandon. P 4-906.

Proposal not considered pending the arrival from the company of sufficient and necessary data. Company notified that they must furnish this department with duplicate signed copies of the log of the well made out on form No. 100, complete history of the well in duplicate, form No. 103, and a subsequent work report (No. 102) covering that portion of the abandonment already done.

## LOST HILLS FIELD.

T. 26 S., R. 20 E., M.D.B. &amp; M.

## SECTION 3.

Associated Oil Co.

Well No. 2, shut off. T 4-534.

Water shut-off approved with understanding that the company may have to make another shut-off should certain conditions arise.

Well No. 2, shut off. T 4-599.

Top water shut-off approved.

Well No. 2, drill. P 4-999.

Supplementary proposal to drill approved with recommendations.

Well No. 2, shut off. T 4-1014.

Shut-off successfully prevents water from above 2540' from reaching sands below that depth.

Well No. 2, drill. P 4-1296.

Supplementary proposal drill approved.

B. B. &amp; E. R. Dudley Petroleum Co.

Well No. 2, redrill. P 4-1492.

Proposal rejected because the company failed to furnish this department with sufficient data.

## SECTION 11.

Associated Oil Co.

Well No. 1, shut off. T 4-540.

Shut-off approved.

## SECTION 12.

Baker &amp; Henshaw Oil Co.

Well No. 1, abandon. P 4-925.

Proposal to pull casing and plug hole answered with recommendations.

Well No. 2, abandoned. P 4-927.

Proposal to abandon well in accordance with the Mining Bureau specifications and leave the well in condition to convert into a water well above the depth of 300', answered with recommendations that the hole be plugged above and below all gas sands encountered in the previous drilling. In attempting to follow out these recommendations the company experienced considerable difficulty and asked that certain specifications be modified. Upon refusal of the bureau to do so the company referred the matter to the District Oil and Gas Commissioners, and the specifications were modified by the board in a manner satisfactory to both the company and this department. These specifications were officially sent to the company in the report, No. P 4-1251.

Well No. 2, abandon. P 4-1251.

Supplementary proposal to abandon in accordance with the decision of the District Oil and Gas Commissioners, answered approving the company's plan to drill to 1670' and fill back to 1270' with cement against the walls of the hole, specifying in detail, plugging, and shooting in such a manner as to adequately protect surrounding territory.

The company experienced considerable mechanical difficulties in carrying out the above recommendations and declared them impractical and impossible, owing to the gas pressure encountered. They then asked for a further revision of specifications.

At a special meeting of the District Oil and Gas Commissioners it was unanimously voted that the company be required to do the work in accordance with their original decision (as stated in Report No. P 4-1251), that the hole be cleaned out to 1670' and filled solid with cement to within 15' or 20' of the shoe of the 8 1/2" casing.

Well No. 3, deepen. P 4-628.

Proposal to deepen rejected as submitted and specifications as to the proper procedure given.

## Baker &amp; Henshaw Oil Co.—Continued.

Well No. 3, shut off. T 4-719.

This test was to determine whether or not the top oil sand was protected from water sands below shoe of shut-off string. The shut-off was approved.

Well No. 3, shut off. T 4-826.

This test was on casing placed to shut off water below oil sand mentioned in Report No. T 4-628, and was not witnessed by this department. Further tests recommended to be witnessed by this department.

Well No. 3, shut off. T 4-838.

Shut-off approved.

Well No. 3, abandon. P 4-926.

Proposal approved, conditionally.

Well No. 3, witness work. T 4-945.

A member of this department witnessed the fact that the well had been drilled to 1002'.

Well No. 3, shut off. T 4-1096.

Test to determine source of water. Test indicated water coming from upper sand. Recommendations were made and submitted as to proper method of continuing abandonment under these conditions.

## SECTION 13.

## Associated Oil Co.

Well No. 10, shut off. T 4-601.

Approved.

Well No. 20, shut off. T 4-603.

Rejected.

Well No. 20, abandon. P 4-729.

Proposal rejected, pending the receipt of more data from the company.

Well No. 25, shut off. T 4-602.

Approved.

## General Petroleum Corp.

Well No. 2-B, drill. P 4-561.

Approved.

Well No. 3-B, drill. DD-915.

Approved.

Well No. 8-B, drill. DD-916.

Approved.

Well No. 12-B, drill. DD-917.

Approved.

Well No. 13-B, drill. P 4-564.

Approved.

Well No. 16-B, drill. P 4-563.

Approved.

Well No. 20-B, drill. DD-918.

Approved.

## SECTION 24.

## California Star Oil Co.

Well No. 2, drill. DD-914.

Approved.

Well No. 16, drill. P 4-744.

Approved.

Well No. 19, drill. P 4-685.

Approved.

Well No. 23, drill. P 4-775.

Approved.

Well No. 26, drill. P 4-623.

Approved.

Well No. 30, redrill. P 4-540.

Approved, with recommendations.

## Security Oil Co.

Well No. 3, deepen. P 4-1149.

Proposal approved.

Well No. 4, deepen. P 4-1410.

Proposal rejected.

Well No. 4, deepen. P 4-1482.

Proposal approved.

Well No. 5, drill. P 4-1297.

Approved.

Well No. 6, drill. P 4-1242.

Proposal approved, with understanding that should top water be encountered this department be notified and a proper shut-off made.

Well No. 16, alter casing. P 4-624.

Work as proposed approved.

Well No. 17, drill. P 4-568.

Proposal approved.

Well No. 17, abandon. P 4-1040.

Proposal to abandon approved, with recommendations.

Well No. 17, report of abandonment. P 4-1269.

Abandonment approved.

Well No. 25, drill. P 4-569.

Proposal to drill approved.

Well No. 25, drill. P 4-641.

Supplementary proposal to drill approved.

T. 26 S., R. 21 E., M.D.B. & M.

## SECTION 19.

## General Petroleum Corp.

Well No. 5, drill. P 4-1098.

Approved.

Well No. 5, shut off. T 4-1032.

Shut-off approved.

Well No. 10, drill. P 4-1474.

Proposal approved.

Well No. 16, deepen. P 4-1361.

Proposal to deepen on account of excess water approved.

Well No. 18, shut off. T 4-1263.

Prospect shut off to determine amount of water in formations below depth of 367 feet.

Well No. 20, deepen. P 4-575.

Proposal approved.

Well No. 21, drill. P 4-564.

Approved, with recommendations.

Well No. 31, drill. P 4-565.

Proposal approved.

Well No. 44, redrill. P 4-1486.

Proposal approved, with the proviso that the company do certain recommended work.

Well No. 61, drill. P 4-501.

Approved, with recommendation that a water string be landed should top water be encountered.

Well No. 64-A, drill. P 4-743.

Proposal approved.

Well No. 70, drill. P 4-847.

Approved.

Well No. 70, drill. P 4-993.

Supplementary proposal to drill approved with recommendations.

Well No. 70, supplementary, drill. P 4-1073.

Approved, with recommendations.

## General Petroleum Corporation—Continued.

Well No. 70, abandon. P 4-1136.

Approved, with recommendations.

Well No. 71, drill. P 4-502.

Proposal approved, with recommendation that water string be landed should top water be encountered.

Well No. 75, shut off. T 4-530.

Final approval not given on account of the large amount of oil in the hole. Passed for production test.

Well No. 78, redrill. P 4-660.

Proposal approved.

Well No. 78-A, redrill. P 4-661.

Proposal approved.

Well No. 98, drill. P 4-566.

Proposal approved.

Well No. 98, shut off. T 4-1237.

Test inconclusive. Another test recommended.

Well No. 98, shut off. T 4-1238.

Shut-off satisfactory.

Well No. 99, drill. P 4-503.

Proposal approved with recommendation that a water string be landed if top water is encountered.

Well No. 104, redrill. P 4-789.

Proposal approved.

Well No. 106, drill. P 4-504.

Proposal answered with recommendation that water string be landed should top water be encountered.

Well No. 107, drill. P 4-567.

Proposal approved.

Well No. 107, supplementary, drill.

Approved.

Well No. 115, drill. P 4-505.

Proposal approved, with recommendation that water string be landed if top water is encountered.

Well No. 115, shut off. T 4-1241.

Shut-off rejected.

Well No. 115, shut off. T 4-1242.

Test unsatisfactory. Recommended that certain work be done and another test made.

Well No. 115, shut off. T 4-1275.

Test unsatisfactory. Another test recommended.

Well No. 115, shut off. T 4-1276.

Test inconclusive. Remedial recommendations made.

Well No. 115, shut off. T 4-1277.

This test made as specified in Report No. T 4-1276. Recommended that the hole be redrilled as specified in Report No. P 4-1309.

Well No. 115, redrill. P 4-1309.

Approved redrilling to exclude top water from top oil sand.

Well No. 115, shut off. T 4-1292.

Recommended that the company drill ahead to 495' and call this department to witness a test to determine source of water in hole.

Well No. 115, shut off. T 4-1342.

Recommendations as to future work on well.

Well No. 115, shut off. T 4-1352.

Shut-off approved for purposes of prospecting ahead.

Well No. 115, supplementary, drill. P 4-1459.

Proposal approved with the understanding that this approval is not to be taken as a precedent in drilling other wells in this territory.

## General Petroleum Corporation—Continued.

Well No. 115, shut off. T 4-1353.

Shut-off approved for the purpose of prospecting ahead.

Well No. 115, supplementary, drill. P 4-1484.

Proposal approved; this department to witness a test of the productivity of the sand at 839' before operations are carried on.

## SECTION 29.

## Associated Oil Co.

Well No. 2-D, drill. P 4-578.

Proposal rejected in its original form. Recommendations as to correct depth for shut-off were made.

Well No. 2-D, shut off. T 4-668.

Shut-off approved.

Well No. 3-C, shut off. T 4-634.

Shut-off approved.

Well No. 3-D, drill. P 4-829.

Proposal approved.

Well No. 3-D, shut off. T 4-848.

Shut-off approved.

Well No. 2-E, drill. P 4-961.

Approved.

Well No. 2-E, shut off. T 4-921.

Shut-off approved.

## SECTION 30.

## Devils Den Consolidated Oil Co.

Well No. 11, deepen. P 4-1160.

Proposal to deepen on account of large water production approved with recommendations as to method to be used.

Well No. 11, shut off. T 4-1190.

Shut-off and sealing intermediate oil and water sands by the mud-laden fluid process approved.

## SECTION 32.

## Universal Oil Co.

Well No. 21, deepen and redrill. P 4-1357.

Proposal approved and recommendations given as to method of protecting sands with mud-laden fluid.

T. 27 S., R. 19 E., M.D.B. & M.

## SECTION 8.

## Standard Oil Co.

Well No. 1, Mercantile, abandon. P 4-1402.

Proposal to abandon answered with detailed specifications for the abandonment of the well and modified by letter to the company, June 4, 1918.

T. 27 S., R. 20 E., M.D.B. & M.

## SECTION 20.

## Petroleum Midway Oil Co.

Well No. 1, abandon. P 4-939.

Proposal to abandon on account of no oil being encountered answered with specifications for abandonment.

## SECTION 26.

## Belridge Oil Co.

Well No. 14, shut off. T 4-572.

Passed for pumping test.

Well No. 14, shut off. T 4-672.

Pumping test indicates water effectually shut off from entering sands below 4131'. Water flowing between 6¼" and 8¼" casing shows that any sands between 4131' and 3989' are being flooded.

## Belridge Oil Co.—Continued.

Well No. 14, drill. P 4-718.

This proposal was received after three tests of shut-off had been made by this department. Because of irregular methods in drilling, the well as drilled was not approved, as later developments might show that damage is being done.

Well No. 14, shut off. T 4-750.

Shut-off on  $4\frac{1}{2}$ " casing at 4316' approved.

Well No. 14, supplementary, drill. P 4-1134.

Proposal answered giving company permission to do proposed work with understanding that the company is not relieved from the obligation of correcting conditions should future developments indicate its necessity.

Well No. 14, shut off. T 4-1034.

Test inconclusive due to the great amount of gas and fluid in the hole. This department recommended the well be put on the producing list and a production test be made later.

Well No. 14, abandon. P 4-1147.

Proposal answered with complete specifications for abandonment.

Well No. 15, shut off. T 4-571.

Approved.

## SECTION 34.

## Standard Oil Co.

Well No. 1, abandon. P 4-1119.

Proposal to abandon on account of no commercial quantity of oil being encountered, approved.

## SECTION 35.

## Belridge Oil Co.

Well No. 3, redrill. P 4-796.

Proposal to redrill on account of well stopping flowing, approved conditionally.

Well No. 3, deepen. P 4-816.

Approved.

Well No. 3, shut off. T 4-1108.

Shut-off approved.

Well No. 9, shut off. T 4-563.

Approved, with recommendations.

Well No. 9, shut off. T 4-710.

Shut-off by 8 $\frac{1}{4}$ " casing approved.

Well No. 17, drill. P 4-1353.

Proposal rejected.

Well No. 17, supplementary, drill. P 4-1407.

Proposal approved for the experimental testing of the mud-laden fluid method of protecting oil sands.

## Union Oil Co.

Well No. 1, shut off. T 4-503.

Rejected.

Well No. 1, deepen. P 4-711.

Approved.

Well No. 2, Belridge, drill. P 4-786.

Proposal approved conditionally.

Well No. 2, Belridge, shut off. T 4-822.

Test inconclusive.

Well No. 2, Belridge, shut off. T 4-1073.

This production test on shut-off indicates presence of water in damaging amounts. Company asked to submit proposal covering work necessary to correct present conditions.

Well No. 3, Belridge, drill. P 4-1069.

Proposal approved conditionally.

## Union Oil Co.—Continued.

Well No. 3, Belridge, redrill. P 4-1216.

Proposal approved conditionally.

Well No. 3, Belridge, shut off. T 4-1160.

Shut-off approved conditionally awaiting further prospecting of sands, above shut-off point of this well, on surrounding property.

Well No. 4, Belridge, drill. P 4-1070.

Proposal approved with recommendations as to landing water string.

Well No. 4, Belridge, shut off. T 4-1269.

The company made two attempts to land the water string, each attempt being made without notifying or getting the approval of this department. The second attempt at shut-off was tested by this department and approved (this report), conditionally.

Well No. 4, Belridge, supplementary, drill. P 4-1464.

Proposal approved conditionally.

Well No. 9, Belridge, drill. P 4-1471.

Proposal approved with recommendations as to landing water string.

Well No. 10, Belridge, drill. P 4-1472.

Proposal approved with recommendations as to landing water string.

Well No. 1, Fee, supplementary, drill. P 4-1218.

Proposal approved conditionally.

Well No. 1, Fee, shut off. T 4-1197.

Test inconclusive.

Well No. 1, Fee, shut off. T 4-1216.

Passed conditionally. Final decision to be given after a production test has been made.

Well No. 2, Gibson, shut off. T 4-1070.

Condition of well unsatisfactory.

Well No. 3, Gibson, drill. P 4-785.

Rejected with recommendations.

Well No. 3, Gibson, supplementary drill. P 4-1217.

Proposal approved conditionally.

Well No. 3, Gibson, shut off. T 4-1224.

Test inconclusive, due to plug in casing.

Well No. 3, Gibson, shut off. T 4-1225.

This test as recommended in Report No. T 4-1224.

Shut-off approved conditionally.

Well No. 4, Gibson, drill. P 4-1067.

Proposal approved, with recommendations as to landing water string.

Well No. 10, Gibson, drill. P 4-1068.

Proposal approved, with recommendations as to landing water string.

Well No. 10, Gibson, shut off. T 4-1109.

Test inconclusive, due to short time well stood before test. Passed for production test.

Well No. 1, Gibson-Fee, supplementary drill. P 4-1238.

Proposal approved, conditionally.

Well No. 2, Gibson-Fee, drill. P 4-1066.

Proposal approved, conditionally.

Well No. 8, Gibson-Fee, drill. P 4-1065.

Proposal approved, with recommendations as to landing water string.

Well No. 8, Gibson-Fee, supplementary drill. P 4-1473.

Proposal rejected. Complete specifications covering work submitted by this department.

T. 27 S., R. 21 E., M.D.B. & M.

## SECTION 4.

## General Petroleum Corp.

Well No. 4, redrill. P 4-574.

Proposal approved.

## General Petroleum Corporation—Continued.

Well No. 56, redrill. DD-919.

Proposal approved.

## Standard Oil Co.

Well No. 16, redrill. P 4-1467.

Proposal approved.

Well No. 51, redrill. P 4-1332.

Proposal to redrill account of well stopping flow, approved.

## SECTION 5.

## General Petroleum Corp.

Well No. 2-B, redrill. P 4-572.

Proposal to redrill account of no production, approved.

## Standard Oil Co.

Well "Vulcan" No. 1, redrill. P 4-840.

Proposal to redrill account of well making 95% water, approved.

Well "Vulcan" No. 1, supplementary redrill. P 4-933.

Proposal approved, with additional recommendations.

Well "Vulcan" No. 1, supplementary redrill. P 4-986.

Proposal answered, with specifications for carrying out work.

Well "Vulcan" No. 1, shut off. T 4-996.

Shut-off approved.

## Universal Oil Co.

Well No. 2, redrill. P 4-790.

Proposal approved, conditionally.

Well No. 2, shut off. T 4-800.

Shut-off approved.

## BELRIDGE FIELD.

T. 28 S., R. 20 E., M.D.B. &amp; M.

## SECTION 1.

## Belridge Oil Co.

Well No. 18, drill. P 4-1493.

This proposal canceled and nullified by Report No. P 4-1637. Approved.

## SECTION 11.

## State Consolidated Oil Co.

Well No. 1, alter casing. P 4-900.

Proposal approved, conditionally.

Well No. 1, deepen and redrill. P 4-1249.

Proposal approved.

T. 28 S., R. 21 E., M.D.B. &amp; M.

## SECTION 28.

## Belridge Oil Co.

Well No. 10-D, deepen. P 4-688.

Proposal answered, with specifications for deepening.

Well No. 10-D, abandon. P 4-1144.

Proposal rejected, pending more data from the company.

Well No. 10-D, supplementary abandon. P 4-1199.

Proposal to abandon answered, with specifications for satisfactorily completing the work. This report to supercede and nullify Report No. P 4-1144.

## SECTION 30.

## Pittsburg-Belridge Oil Co.

Well No. 1, redrill. P 4-715.

Approved.

Well No. 1, shut off. T 4-700.

Test inconclusive. Final decision withheld, pending result of bailing test.

## Pittsburg-Belridge Oil Co.—Continued.

Well No. 1, shut off. T 4-1236.

This test in accordance with recommendations in Report No. T 4-700. The pumping test showed 2.0% water. The shut-off is approved.

## SECTION 33.

## Belridge Oil Co.

Well No. 5-D, production test. T 4-729.

This test showed that water above 2578' is prevented from entering sands below that depth, but this department has been given no opportunity to determine whether or not formations above that depth have been properly protected.

Well No. 6-D, drill. P 4-533.

Proposal approved.

Well No. 6-D, supplementary drill. P 4-591.

Proposal approved.

Well No. 6-D, shut off. T 4-677.

Test indicated that water above point of shut-off is successfully excluded from formations below.

Well No. 6-D, supplementary drill. P 4-792.

Superseded by Report No. P 4-804.

Well No. 6-D, supplementary drill. P 4-804.

Proposal approved.

Well No. 6-D, shut off. T 4-768.

Recommendations that the hole be drilled in and a production test made.

Well No. 6-D, deepen. P 4-966.

Proposal approved, with recommendations.

Well No. 6-D, shut off. T 4-1056.

Test showed all formations below 3296' are protected from water above that point. Approval not given because the company failed to comply with the bureau's specifications regarding protection of formations between landing points of the two strings of casing.

Well No. 6D, abandon. P 4-1293.

Proposal answered, with rejection and complete specifications for proper abandonment.

Well No. 7-D, drill. P 4-588.

Approved.

Well No. 7-D, shut off. T 4-654.

Shut-off approved.

Well No. 7-D, supplementary drill. P 4-894.

Proposal approved, with additional recommendations.

Well No. 7-D, deepen. P 4-964.

Proposal approved.

Well No. 7-D, redrill. P 4-1099.

Proposal rejected, due to the fact that the company failed to notify this department of tests.

Well No. 7-D, supplementary drill. P 4-1165.

Proposal approved. Company advised that this department must be notified to witness all tests of shut-off, whether successful or not.

Well No. 7-D, shut off. T 4-1291.

Shut-off rejected. Permission to drill ahead conditionally given.

Well No. 8-D, drill. P 4-590.

Approved.

## SECTION 34.

## Belridge Oil Co.

Well No. 9-D, drill. P 4-748.

Due to an error in the company's notice, this well was reported as located in section 33, T. 28 S., R. 21 E., instead of in section 34 of the same township and range. This report was later canceled and superseded by Report No. P 4-1677.

Belridge Oil Co.—Continued.

Well No. 11-D, drill. P 4-749.

Proposal approved. Due to an error in the company's notice, this well was located in section 33, as was Well No. 9-D.

T. 29 S., R. 20 E., M.D.B. & M.

SECTION 36.

Shear Petroleum Co.

Well No. 13, drill. P 4-531.

Proposal approved.

T. 29 S., R. 21 E., M.D.B. & M.

SECTION 1.

Reward Oil Co.

Well No. 2, drill. P 4-815.

Approved.

Well No. 2, shut off. T 4-908.

Shut-off approved.

Well No. 2, shut off. T 4-1146.

Shut-off rejected.

Well No. 2, supplementary drill. P 4-1273.

Proposal to recement approved.

Well No. 2, supplementary drill. P 4-1283.

Approved, with recommendations.

Well No. 2, shut off. T 4-1222.

Rejected.

Well No. 2, shut off. T 4-1329.

Test inconclusive. Another test recommended.

Well No. 2, shut off. T 4-1336.

Test inconclusive. Another test recommended.

Well No. 2, shut off. T 4-1337.

Test failed to show source of water. Recommendations made as to method of more accurately locating water.

SECTION 2.

General Petroleum Corp.

Well No. 98, shut off. T 4-560.

Approval not given, because the company failed to furnish this department with complete information.

Well No. 98, shut off. T 4-725.

Test to determine the amount of water produced by pumping. In view of the fact that the water might be exhausted by continuous pumping, further pumping was recommended.

Well No. 99, shut off. T 4-606.

Shut-off approved.

Well No. 122, shut off. T 4-525.

Shut-off approved.

Well No. 125, shut off. T 4-519.

Shut-off satisfactory.

Well No. 126, shut off. T 4-658.

Shut-off approved.

Well No. 127, shut off. T 4-605.

Shut-off approved.

Well No. 140, drill. P 4-1062.

Proposal approved.

Well No. 141, drill. P 4-973.

Proposal approved.

Well No. 141, shut off. T 4-1196.

Shut-off rejected, with recommendations.

## General Petroleum Corporation—Continued.

Well No. 141, supplementary drill. P 4-1355.

Proposal approved.

Well No. 141, shut off. T 4-1266.

Shut-off approved for prospecting purposes.

Well No. 141, shut off. T 4-1328.

This shut-off approved for prospecting ahead in an endeavor to locate a tar sand carrying water. When this is located the company is to shut off as approved in Report No. P 4-1355.

Well No. 142, drill. P 4-974.

Proposal approved.

Well No. 142, shut off. T 4-1072.

Test inconclusive, due to plug in casing. Later tested by this department and found wet. As source of water was doubtful, it was agreed to drill ahead in an endeavor to locate sand.

Well No. 142, supplementary drill. P 4-1195.

Proposal to drill ahead, landing second water string mentioned in Report No. T 4-1072, approved.

Well No. 142, shut off. T 4-1169.

Test on second water string approved.

Well No. 142, supplementary, drill. P 4-1280.

Proposal to land third water string approved.

Well No. 142, shut off. T 4-1215.

Approved.

Well No. 142, shut off. T 4-1298.

Test showed water above 670' successfully excluded from formations below that depth. The company had three water strings in this hole. As per proposal, approved by this department in Report No. P 4-1355, they loosened and relanded the second string at a point below the original landing of the third string.

Well No. 149, drill. P 4-514.

Proposal approved.

Well No. 149, shut off. T 4-704.

Recommended a new shut-off be made.

Well No. 149, shut off. T 4-721.

Shut-off approved.

Well No. 150, drill. P 4-507.

Proposal approved.

Well No. 150, shut off. T 4-803.

Shut-off rejected, due to the fact that the company had shut off 45' lower than proposed and approved by this department without submitting information showing why the change was necessary.

Well No. 151, drill. P 4-508.

Proposal approved.

Well No. 151, shut off. T 4-753.

Recommended that the hole be bailed out, after cleaning, and another test made with screen pipe.

Well No. 151, shut off. T 4-761.

Shut-off approved.

Well No. 152, drill. P 4-513.

Proposal approved.

Well No. 152, shut off. T 4-722.

Shut-off approved.

Well No. 153, drill. P 4-509.

Proposal approved.

Well No. 153, shut off. T 4-777.

Shut-off approved.

Well No. 154, drill. P 4-510.

Proposal approved.

## General Petroleum Corporation—Continued.

Well No. 154, shut off. T 4-820.

Shut-off rejected because the company shut off 28' lower than they proposed without notifying this department.

Well No. 154, supplementary, drill. P 4-937.

Proposal approved conditionally.

Well No. 154, shut off. T 4-889.

Shut-off approved. This report to supercede and nullify report No. T 4-820.

Well No. 155, drill. P 4-511.

Proposal approved.

Well No. 155, shut off. T 4-865.

Shut-off approved.

Well No. 156, drill. P 4-512.

Proposal approved.

Well No. 156, shut-off. T 4-843.

Shut-off approved.

Well No. 174, drill. P 4-1120.

Proposal approved.

Well No. 174, shut off. T 4-1369.

Shut-off approved.

Well No. 175, drill. P 4-1010.

Proposal approved.

Well No. 175, shut off. T 4-1294.

Shut-off rejected. Recommendations submitted.

Well No. 175, supplementary, drill. P 4-1343.

Proposal approved as a temporary measure to aid in prospecting ahead.

Well No. 175, shut off. T 4-1375.

Shut-off approved.

Well No. 175, supplementary, drill. P 4-1499.

Proposal approved.

Well No. 176, drill. P 4-1014.

Proposal approved.

Well No. 176, shut off. T 4-1114.

Shut-off approved.

Well No. 177, drill. P 4-1015.

Proposal approved.

Well No. 177, shut off. T 4-906.

Shut-off approved.

Well No. 178, drill. P 4-1016.

Proposal approved.

Well No. 178, shut off. T 4-967.

Shut-off approved.

Well No. 178, supplementary, drill. P 4-1095.

Proposal approved.

Well No. 178, shut off. T 4-1006.

Test inconclusive due to plug in casing.

Well No. 178, shut off. T 4-1007.

Shut-off by 10" as a temporary measure approved.

Well No. 178, shut off. T 4-1092.

Test inconclusive due to the great amount of tar sand in the hole.

Well No. 178, shut off. T 4-1097.

Test inconclusive. Another test recommended.

Well No. 178, shut off. T 4-1100.

Shut-off approved.

Well No. 179, drill. P 4-1017.

Proposal approved.

## General Petroleum Corporation—Continued.

- Well No. 180, drill. P 4-1005.  
Proposal approved.  
Well No. 181, drill. P 4-1006.  
Proposal approved.  
Well No. 182, drill. P 4-1007.  
Proposal approved.  
Well No. 183, drill. P 4-1008.  
Proposal approved.  
Well No. 184, drill. P 4-1009.  
Proposal approved.  
Well No. 184, shut off. T 4-1131.  
Shut-off approved.  
Well No. 185, drill. P 4-1060.  
Proposal approved.  
Well No. 186, drill. P 4-1061.  
Proposal approved.  
Well No. 187, drill. P 4-1132.  
Proposal approved.

## SECTION 3.

## Marina Oil Co.

- Well No. 6, shut off. T 4-554.  
Approval not given on account of the failure of the company to furnish complete data.  
Well No. 7, drill. DD-920.  
Proposal approved.  
Well No. 7, supplementary drill. P 4-1176.  
Proposal approved.  
Well No. 7, shut off. T 4-1249.  
Shut-off approved.  
Well No. 8, drill. DD-921.  
Proposal approved.  
Well No. 8, supplementary drill. P 4-1167.  
Proposal approved.  
Well No. 8, shut off. T 4-1338.  
Test inconclusive. Another test recommended.  
Well No. 8, shut off. T 4-1339.  
Shut-off approved.  
Well No. 8, supplementary, drill. P 4-1500.  
Proposal approved.  
Well No. 8, shut off. T 4-1386.  
Test inconclusive. This department recommended that hole be cleaned and bailed for another test.  
Well No. 10, shut off. T 4-555.  
Passed, conditionally.  
Well No. 10, redrill. P 4-1103.  
Proposal approved.  
Well No. 10, shut off. T 4-1057.  
Test inconclusive. Another test recommended.  
Well No. 10, shut off. T 4-1058.  
Shut-off approved. Company requested to submit supplementary notice outlining further proposed operations.  
Well No. 10, supplementary drill.  
Proposed work approved.  
Well No. 10, shut off. T 4-1176.  
Test inconclusive. Another test recommended.  
Well No. 10, shut off. T 4-1177.  
Shut-off approved.

## Marina Oil Co.—Continued.

Well No. 10, supplementary drill. P 4-1351.

Proposal approved.

Well No. 10, shut off. T 4-1325.

Shut-off rejected; recommended recementing.

Well No. 14, drill. DD-926.

Proposal approved.

Well No. 14, shut off. T 4-944.

Shut-off approved.

Well No. 15, drill. DD-922.

Proposal approved.

Well No. 15, shut off. T 4-991.

Shut-off approved.

Well No. 16, drill. DD-923.

Proposal approved.

Well No. 16, shut off. T 4-1103.

Shut-off approved.

Well No. 16, supplementary drill. P 4-1253.

Proposal approved, with recommendations.

Well No. 16, shut off. T 4-1163.

Test indeterminate due to leaky bridge.

Well No. 16, shut off. T 4-1164.

This test was made in an endeavor to locate source of water in this well, which it did not do. Another test was recommended with specifications covering work necessary to carry out same.

Well No. 16, shut off. T 4-1171.

This test was made in accordance with recommendations outlined in Report No. T 4-1164, and as a result of this test further recommendations were issued to cover conditions on this well.

Well No. 16, shut off. T 4-1258.

Specifications made in Report No. T 4-1164 carried out and this test made. The shut-off was approved.

Well No. 16, supplementary drill. P 4-1497.

Proposal approved.

Well No. 19, production test. T 4-724.

Pumping test to locate source of water failed. Further pumping recommended.

Well No. 21, shut off. T 4-577.

Shut-off approved.

Well No. (old) 23, abandon. P 4-841.

Proposal to abandon on account of mechanical difficulties encountered in drilling, approved, with the understanding that should future developments show sands to be of any commercial value, it will be necessary for the company to protect such sands by remedying existing conditions.

Well No. (new) 23, drill. P 4-842.

Proposal approved.

Well No. (new) 23, shut off. T 4-799.

Shut-off approved.

Well No. 24, drill. P 4-547.

Proposal approved.

Well No. 24, supplementary drill. P 4-1184.

Proposal approved.

Well No. 25, drill. P 4-548.

Proposal approved.

Well No. 25, supplementary drill.

Proposal approved.

Well No. 26, drill. P 4-549.

Proposal approved.

## Marina Oil Co.—Continued.

Well No. 27, drill. P 4-550.

Proposal approved. The company later notified this department that owing to a change in their drilling program the well would not be drilled.

Well No. 30, shut off. T 4-806.

Shut-off approved.

Well No. 31, drill. P 4-551.

Proposal approved.

Well No. 33, drill. P 4-553.

Proposal approved.

Well No. 34, drill. P 4-554.

Proposal approved. The company later notified this department that owing to a change in drilling program, this well would not be drilled.

Well No. 35, shut off. T 4-617.

Shut-off approved.

Well No. 36, shut off. T 4-521.

Shut-off approved.

Well No. 36, deepen and redrill. P 4-1100.

Proposal approved, with recommendations.

Well No. 36, shut off. T 4-1143.

Test inconclusive. Another test recommended.

Well No. 36, shut off. T 4-1153.

This report to cancel and waive recommendations in Report No. T 4-1143. Recommended that the company go ahead as outlined in Report No. P 4-1100.

Well No. 36, shut off. T 4-1181.

Test to determine whether or not certain sands carry water. Company given permission to proceed with operations as per Report No. P 4-1100.

Well No. 36, shut off. T 4-1344.

Test inconclusive. Redemial work recommended.

Well No. 37, drill. DD-924.

Proposal approved.

Well No. 37, shut off. T 4-862.

Shut-off approved.

Well No. 37, shut off. T 4-1021.

Test inconclusive.

Well No. 37, shut off. T 4-1022.

Test indicates well making water. Company's proposal to let stand for another test approved.

Well No. 37, supplementary drill. P 4-1194.

Proposal approved, conditionally.

Well No. 38, drill. P 4-555.

Proposal approved.

Well No. 39, drill. P 4-556.

Proposal approved.

Well No. 40, drill. P 4-557.

Proposal approved.

Well No. 41, drill. P 4-558.

Proposal approved. The company later notified this department that owing to a change in drilling program, this well would not be drilled.

Well No. 42, shut off. T 4-770.

The water string in this well was landed and cemented 30' deeper than proposed, but owing to the fact that the company used 160 sacks of cement in the work, it was approved by this department.

Well No. 42, shut off. T 4-797.

Shut-off approved.

Well No. 42, supplementary drill. P 4-912.

Proposal approved.

## Marina Oil Co.—Continued.

Well No. 51, shut off. T 4-877.

Shut-off approved.

Well No. 55, shut off. T 4-505.

Shut-off approved.

## SECTION 8.

## Standard Oil Co.

Well No. 1, shut off. T 4-717.

Test shows 10" casing cemented at 3150' effectually prevents any water above that point from infiltrating to the formations below the shoe of the 10".

Well No. 1, abandon. P 4-1093.

Proposal to abandon answered with complete specifications for effectually carrying out the work.

Well No. 1, supplementary abandon. P 4-1258.

Proposal approved, with recommendations.

## SECTION 11.

## General Petroleum Corp.

Well No. 8-B, drill. P 4-846.

Proposal approved.

Well No. 8-B, supplementary drill. P 4-915.

Proposal approved, conditionally.

Well No. 14-B, shut off. T 4-518.

Shut-off unsatisfactory. A further proposal recommended.

Well No. 14-B, shut off. T 4-594.

Test inconclusive. Further bailing tests or a pumping test recommended.

Well No. 14-B, abandon. P 4-828.

Proposal to abandon on account of non-productivity of sands, approved with added recommendations.

Well No. 14-B, supplementary abandon. P 4-994.

Proposal approved. This proposal was submitted in accordance with recommendations contained in Report No. P 4-828.

## SECTION 12.

## Marina Oil Co.

Well No. 1, drill. P 4-1003.

Proposal approved.

Well No. 1, supplementary drill. P 4-1036.

Proposal approved.

Well No. 1, shut off. T 4-1024.

Shut-off approved.

Well No. 1, supplementary drill. P 4-1187.

Proposal approved.

Well No. 1, shut off. T 4-1154.

Test inconclusive. Another test recommended.

Well No. 1, shut off. T 4-1158.

Shut-off approved.

Well No. 1, supplementary drill. P 4-1265.

Proposal approved, with understanding that should more water be encountered below the 8½" a proposed method of drilling under these conditions be submitted.

Well No. 1, supplementary drill. P 4-1298.

Proposal approved.

Well No. 1, shut off. T 4-1259.

Shut-off unsatisfactory. A deeper shut-off recommended.

Well No. 1, supplementary drill. P 4-1409.

Proposal approved.

Well No. 1, shut off. T 4-1356.

Test inconclusive. Recommended that the hole be bailed for another test.

## Marina Oil Co.—Continued.

Well No. 1, shut off. T 4-1357.

Test indicates water coming in below shut-off. Recommended that the hole be drilled ahead and a shut-off be made in first suitable formation.

Well No. 1, supplementary drill. P 4-1498.

Proposal approved.

## SECTION 21.

## Standard Oil Co.

Well No. 3, drill. P 4-1333.

Proposal answered, with recommendations that the hole be drilled in such a manner that tests could be made on certain shallow oil sands.

## SECTION 26.

## Pacific Crude Oil Co.

Well No. 9, shut off. T 4-636.

Shut-off approved.

Well No. 9, abandon. P 4-922.

Proposal to abandon answered with specifications by this department.

Well No. 9, witness work. P 4-876.

Witnessed mudding, in accordance with Report No. P 4-922. Work approved.

Well No. 9, witness work. T 4-896.

Member of this department witnessed the placing of a cement plug, as per Report No. P 4-922. Approved.

Well No. 9, abandon. P 4-983.

Proposal answered, with complete specifications as to proper method of abandonment.

Well No. 9, witness work. T 4-928.

Member of this department witnessed the mudding, under pressure, of open hole. Approved.

Well No. 17, redrill. P 4-1502.

Proposal approved, with recommendations.

Well No. 53, shut off. T 4-1126.

Previous test showed 60' plug in casing. This production test was made in accordance with recommendations made at that time. Test showed 60% water. Recommended that company submit proposal stating in detail what they plan to do to correct existing conditions.

Well No. 55, drill. P 4-645.

Proposal approved.

Well No. 55, shut-off. T 4-886.

Test not conclusive. Well passed for production test.

Well No. 55, shut off. T 4-1019.

Records of well incomplete. Test indicates water in excessive amounts has access to well, and the condition of same is rejected. Recommended that the company submit a proposal outlining work necessary to improve conditions.

Well No. 55, bridge and test. P 4-1226.

Proposal approved. This department to witness test of shut-off.

Well No. 55, shut off. T 4-1309.

Test not conclusive. Another test recommended.

Well No. 55, shut off. T 4-1330.

Hole bridged for this test in an attempt to locate water. Test showed 84" casing effectually shuts off water. Further tests recommended.

Well No. 57, drill. P 4-1049.

Proposal approved.

Well No. 57, shut off. T 4-1089.

Shut-off rejected. Recommended the company submit a supplementary proposal outlining a method of correcting existing conditions.

Well No. 57, shut off. T 4-1253.

Test inconclusive. Another test recommended.

**Pacific Crude Oil Co.—Continued.**

Well No. 57, shut off. T 4-1264.

Shut-off approved.

Well No. 57, supplementary drill. P 4-1422.

Proposal approved.

**United Western Consolidated Oil Co.**

Well No. 2, redrill. P 4-664.

Proposal approved, provided tar sands are thoroughly mudded before cementing.

Well No. 3, drill. P 4-541.

Proposal satisfactory, but approval withheld until receipt of signed copies of the logs of the company's wells.

Well No. 3, shut off. T 4-647.

Shut-off by 8½" satisfactory. Final decision as to condition of the well withheld, pending receipt of signed statement in duplicate of test made of shut-off by 11½" casing.

Well No. 3, shut off. T 4-653.

Test indicates shut-off leaking or that water is returning through bridge. Well passed for production test.

Well No. 4, drill. P 4-646.

Proposal approved.

**SECTION 27.****Standard Oil Co.**

Well No. 2, Midway Premier, shut off. T 4-950.

Well passed for production test.

Well No. 2, Midway Premier, supplementary drill. P 4-1219.

Answer withheld approval pending receipt of signed copies of log.

Well No. 2, Midway Premier, supplementary drill. P 4-1229.

Proposal answered, with specifications.

**SECTION 36.****West Penn Oil Co.**

Well No. 1, shut off. T 4-614.

On account of sand heaving in the hole a satisfactory bailing test could not be made. Well passed for production test.

**Standard Oil Co.**

Well No. 2, shut off. T 4-511.

Well passed for production test, because of the large amount of oil in hole.

**McKITTRICK FIELD.**

T. 29 S., R. 22 E., M.D.B. & M.

**SECTION 32.****Barnsdale, Drake and Yancy Oil Co.**

Well No. 1, witness work. D-929.

Test indicated cement set at 1666'.

T. 30 S., R. 21 E., M.D.B. & M.

**SECTION 11.****Southern Pacific Co., Fuel Oil Department.**

Well No. 3, shut off. T 4-1069.

Reported production test not witnessed by this department, the results being obtained from monthly production reports submitted by the company. On the basis of these reports the shut-off was approved.

Well No. 4, shut off. T 4-624.

Shut-off approved.

Well No. 5, drill. P 4-1206.

Proposal approved.

Well No. 5, shut off. T 4-1257.

Shut-off approved.

Well No. 6, drill. P 4-1458.

Proposal approved.

## Josephine Oil Co.

Well No. 2, redrill. P 4-880.

Proposal approved, in part, with recommendations covering balance of work.

Well No. 2, abandon. P 4-1489.

Proposal to abandon, on account of no commercial production, approved, with recommendations.

## Jackson Oil Co.

Well No. 6, redrill. P 4-952.

Proposal to redrill oil string approved.

Well No. 9, shut off. T 4-517.

Shut-off approved.

Well No. 10, drill. P 4-621.

Proposal approved.

Well No. 10, shut off. T 4-772.

Approval was withheld on account of the fact that the casing was landed deeper than proposed and approved, and the consequent possibility that oil sands were cased off behind the water string.

Well No. 10, supplementary to drill. P 4-S27.

Withheld approval to proposal to carry 10" casing deeper until the result of the work could be observed. At the time of submitting proposal the work had already been done.

Well No. 11, drill. P 4-951.

Proposal approved conditionally.

Well No. 11, shut off. T 4-1101.

Test indicated that water above point of shut-off was effectually prevented from penetrating formations below that point. Shut-off approved, conditionally.

Well No. 12, drill. P 4-1336.

Proposal approved, conditionally.

Well No. 12, shut off. T 4-1297.

Shut-off approved, conditionally.

## East Puente Oil Co.

Well No. 3, deepen and redrill. P 4-1191.

Proposal approved, conditionally.

Well No. 3, shut off. T 4-1120.

Shut-off rejected.

Well No. 3, shut off. T 4-1255.

Test inconclusive. Another test recommended.

Well No. 3, shut off. T 4-1326.

Passed for production test.

Well No. 6, shut off. T 4-546.

Shut-off approved.

Well No. 7, drill. DD-913.

Proposal approved.

Well No. 7, shut off. T 4-679.

Shut-off approved.

Well No. 8, drill. P 4-788.

Proposal approved.

Well No. 8, shut-off. T 4-943.

Because of the fact that the water string was landed 422' deeper than proposed, and the further fact that the test was made with a 20' plug in the hole, the test was unsatisfactory. This test was made by the company, in the presence of several witnesses from the surrounding leases.

Well No. 8, report on method of drilling. P 4-1142.

This report was issued following the receipt of a detailed statement from the company in regard to their having landed the water string at 1122', or 422' deeper than proposed in their notice of intention to drill of October 15, 1918, as approved in Report No. P 4-788, of October 25, 1918. The statement is as follows:

"The 11½" casing, the outer water string, was not used in shutting off the water for the following reasons: When we got down near the landing place, which is about 50' in the gray shale usually found between 700' and 800', the casing when allowed to stand very long would get tight, showing the effect of cave, so after getting it down where we wanted to land we could not keep it free long enough to cement, so it was left at 785', and we run the 9½" casing in and carried it to 1122', which was just on top of the oil sand: this string was then cemented with 4 tons in the bottom; we then loosened up the 11½" and tamped a sand bridge of 140' around the 9½", then pulled the 11½" out, and run 300' of 1¼" pipe down the outside of the 9½" and pumped 5 tons of cement on the sand bridge."

This method of drilling new oil wells was not approved by this department, as there was no means of showing that upper oil measures cased off behind the 9½" casing are not being damaged by top water.

The matter is being held in abeyance until such time as developments indicate whether this well is contributing to the already serious water condition in this vicinity.

Well No. 9, drill. P 4-968.

Proposal approved.

Well No. 9, shut off. T 4-979.

Shut-off approved.

Well No. 13, deepen and redrill. P 4-1295.

Proposal approved, conditionally.

Well No. 15, deepen. P 4-1182.

Proposal rejected, for lack of log.

Well No. 15, deepen. P 4-1227.

Proposal was received February 16, 1918. On March 12 this department received log of well, as per request in Report No. P 4-1182, from which data was obtained to the effect that the work had been completed. Approval was withheld.

Well No. 15, shut off. T 4-1180.

Test inconclusive, owing to the fact that the hole was bailed only to 600'. Another test recommended.

## SECTION 12.

Southern Pacific Co., Fuel Oil Department.

Well No. 128, redrill. P 4-681.

Proposal to redrill, on account of collapsed oil string, approved, with recommendations.

Well No. 128, shut off. T 4-711.

Test to determine source of water. Test showed well making no top water. Recommended further tests.

Well No. 128, shut off. T 4-1062.

This was a production test made after plugging a tar sand and an oil sand. During a run of 127 days the well averaged 150 bbls. of fluid, 20% water and 30% emulsion. Source of water unknown. This department recommended that the company make tests to determine the source of this water and submit a proposal outlining a method of improving conditions.

## SECTION 13.

Southern Pacific Co., Fuel Oil Department.

Well No. 17, redrill. P 4-793.

Proposal approved.

Well No. 18, abandoned. P 4-865.

Proposal approved.

Well No. 218, drill. P 4-1079.

Proposal approved.

Well No. 218, shut off. T 4-1053.

Shut-off approved.

## Olig Crude Oil Co.

Well No. 2 (old), abandoned. P 4-1146.

Proposal rejected for lack of logs of the several wells drilled under this number.

Well No. 2 (new), drill. P 4-1145.

Proposal rejected, pending receipt of statement showing elevation and location of the well.

## SECTION 14.

## San Francisco and McKittrick Oil Co.

Well No. 13, deepen. P 4-735.

Proposal approved, production test to be made later.

Well No. 13, production test. T 4-1199.

This test in accordance with Report No. P 4-735. After 118 days the well was producing at the rate of 80 bbls. per day, of which 2.8% was water. As a result of this test the deepening was approved.

Well No. 14, deepen. P 4-745.

Proposal approved. Called for a production test to be made later.

Well No. 14, production test. T 4-1198.

This test made in accordance with Report No. P 4-745. After 91 days the well was producing at the rate of 60 bbls. of fluid, of which 3.2% was water. The deepening of the well was approved.

Well No. 17, deepen. P 4-546.

Proposal approved with the understanding that, should water be encountered while deepening, this department should be notified.

Well No. 18, deepen. P 4-878.

Deepening approved on the condition that, should water be encountered, this department be immediately notified. A production test to be made after completion of work.

Well No. 18, production test. T 4-1200.

Test made as specified in Report No. P 4-878. After 50 days the well was producing at the rate of 35 bbls. of fluid per day, of which 3.2% was water. Deepening approved.

T. 30 S., R. 22 E., M.D.B. & M.

## SECTION 6.

## Standard Oil Co., "Seabreeze."

Well No. 1, supplementary redrill. P 4-604.

Proposal approved; sufficient lime and cement to be used to seal all formations between the landing point of the new string of 10" and the shoe of the 12½" casing.

Well No. 1, shut off. T 4-580.

Well passed for production test.

## Standard Oil Co., "McKittrick."

Well No. 3, shut off. T 4-520.

Shut-off satisfactory.

Well No. 3, redrill. P 4-1172.

Proposal approved.

Well No. 4, abandon. P 4-746.

Proposal answered with specifications for abandonment.

## Nevada County Oil Co.

Well No. 47, redrill. P 4-895.

Proposal approved.

Well No. 47, supplementary redrill. P 4-943.

Proposal approved; shut-off to be witnessed. Recommended recementing instead of landing a new string of casing.

Well No. 48, drill. P 4-613.

Proposal approved.

Well No. 48, shut off. T 4-686.

After 130 days well was producing at the rate of 20 bbls. of fluid daily, with only a trace of water. Shut-off approved.

## Nevada County Oil Co.—Continued.

Well No. 48, redrill. P 4-1113.

Proposal approved. 10" water string not to be disturbed.

Well No. 49, drill. P 4-594.

Proposal approved.

Well No. 49, shut off. T 4-635.

Shut-off approved.

Well No. 50, drill. P 4-598.

Proposal approved.

Well No. 50, supplementary, drill. P 4-592.

Proposal approved: this department to witness mudding.

Well No. 50, shut off. T 4-1054.

Shut-off approved.

## SECTION 8.

## Standard Oil Company.

Well No. 2, "McKittrick," shut off. T 4-622.

Shut-off approved.

Well No. 2, "McKittrick," redrill. P 4-873.

Consideration of proposal withheld, pending receipt of duplicate signed copies of log.

Well No. 2, "McKittrick," supplementary drill. P 4-941.

Proposal approved conditionally.

Well No. 7, "McKittrick," drill. P 4-890.

Proposal approved conditionally.

Well No. 7, "McKittrick," supplementary drill. P 4-1177.

Proposal answered with specifications as to method of deepening.

Well No. 7, "McKittrick," shut off. T 4-1079.

Confirmed the company's report that the shut-off was ineffective due to the presence of water sand immediately below the shoe of the 12½" casing.

Well No. 7, "McKittrick," supplementary drill. P 4-1222.

Proposal to drill out through 12½" casing, and land 10" casing for water string, approved.

## SECTION 16.

Well No. 1, "Spreckels," shut off. T 4-670.

Shut-off approved.

Well No. 1, "Spreckels," supplementary redrill. P 4-907.

Consideration withheld pending receipt of signed copies of log.

Well No. 1, "Spreckels," supplementary redrill. P 4-930.

Proposal approved provided all formation cased off by the 8½" casing be mudded under pressure and cemented with at least 10 tons of cement.

Well No. 2, "Spreckels," supplementary drill. P 4-826.

Proposal approved with reservations.

Well No. 2, "Spreckels," shut off. T 4-839.

Shut-off approved with reservations.

Well No. 2, "Spreckels," special test. T 4-946.

Test indicates that oil showing from 3022' to 3300' is not productive.

Well No. 2, "Spreckels," redrill. P 4-1151.

Proposal approved with reservations.

Well No. 2, "Spreckels," supplementary, redrill. P 4-1318.

Proposal approved conditionally.

Well No. 2, "Spreckels," special test. T 4-1313.

Test inconclusive. Additional test recommended.

Well No. 2, "Spreckels," redrill. P 4-1429.

Proposal approved.

## SECTION 20.

## Southern Pacific Company, Fuel Oil Department.

Well No. 15, drill. P 4-1373.

Proposal approved conditionally.

## Southern Pacific Co., Fuel Oil Department—Continued.

Well No. 15, shut off. T 4-1368.

Shut-off approved.

## SECTION 34.

## Doheny-Pacific Petroleum Co.,

Well No. 1, abandon. P 4-680.

Proposal rejected, with recommendation.

Well No. 1, special test. T 4-870.

Placing of cement plug approved.

## Combined Oil Company, "Belgian."

Well No. 3, abandon. P 4-539.

Proposal answered with specifications.

## MIDWAY FIELD.

T. 31 S., R. 22 E., M.D.B. & M.

## SECTION 2.

## Doheny-Pacific Petroleum Co.

Well No. 1, redrill. P 4-1180.

Proposal approved.

## Associated Oil Company.

Well No. 23, deepen. P 4-938.

Proposal approved conditionally.

Well No. 24, redrill. P 4-1203.

Proposal approved.

Well No. 33, drill. P 4-1118.

Proposal approved.

Well No. 33, shut off. T 4-1343.

Approval withheld owing to the fact that the shut-off was made 206' deeper than proposed and approved, and without due notice to this department.

Well No. 34, drill. P 4-1046.

Proposal approved.

Well No. 34, shut off. T 4-1116.

Test inconclusive due to plug in casing. Further test recommended.

Well No. 34, shut off. T 4-1119.

Shut-off approved.

Well No. 34, shut off. T 4-1265

Shut-off approved.

## SECTION 3.

## Doheny-Pacific Petroleum Co.

Well No. 4, drill. P 4-905.

Proposal approved.

Well No. 4, shut off. T 4-883.

Recommended additional test.

Well No. 4, shut off. T 4-1144.

Test indeterminate, owing to fact that well was bailed only to 400', and that bailer was run before arrival of inspector. Well passed for production test.

Well No. 5, drill. P 4-904.

Proposal approved.

Well No. 5, abandon. P 4-1371.

Consideration withheld pending receipt of signed copies of log and history of well.

Well No. 5, abandon. P 4-1416.

Proposal approved, with recommendations.

Well No. 5, special test. T 4-1348.

Test satisfactory.

Well No. 5, special test. T 4-1381.

Mudding approved.

## SECTION 13.

## Doheny-Pacific Petroleum Co.—Continued.

Well No. 2, redrill. P 4-1082.

Consideration withheld pending receipt of signed copies of log.

Well No. 2, shut off. T 4-1040.

Approval withheld pending receipt of signed copies of log.

Well No. 2, redrill. P 4-1153.

Proposal approved with reservations.

Well No. 6, drill. P 4-1368.

Proposal answered with recommendation as to point of shut-off.

## SECTION 14.

## Potter Oil Company.

Well No. "C," abandon. P 4-620.

Proposal answered with specifications.

Well No. "C," supplementary, abandon. P 4-682.

Proposal approved.

Well No. 5, drill. P 4-1244.

Proposal approved.

Well No. 6, drill. P 4-1163.

Proposal approved.

Well No. 6, shut off. T 4-1117.

Test inconclusive; passed for production test.

Well No. 7, drill. P 4-1243.

Proposal approved.

Well No. 7, shut off. T 4-1213.

Shut-off approved.

Well No. 8, drill. P 4-1080.

Proposal approved.

Well No. 8, shut off. T 4-1088.

Test inconclusive; additional test recommended.

Well No. 8, shut off. T 4-1098.

Shut-off approved. Tested through 985' 8 $\frac{1}{4}$ " 28-lb. casing with one joint screen casing on bottom.

Well No. 9, drill. P 4-935.

Proposal approved.

Well No. 9, shut off. T 4-890.

Test inconclusive; passed for production test.

Well No. 9, production test. T 4-1004.

Shut-off approved.

Well No. 10, drill. P 4-797.

Proposal approved.

Well No. 10, shut off. T 4-816.

Passed for production test.

Well No. 10, production test. T 4-1003.

Shut-off approved.

Well No. 11, drill. P 4-934.

Proposal approved.

Well No. 11, shut off. T 4-1001.

Shut-off approved.

Well No. 12, drill. P 4-798.

Proposal approved.

Well No. 12, shut off. T 4-882.

Shut-off approved.

## General Petroleum Corporation.

Well No. 16, redrill. P 4-1048.

Proposal approved.

## Manley &amp; McGinn.

Well No. 3-C, redrill. P 4-1448.

Decision withheld pending result of bailing test.

Well No. 3-C, special test. T 4-1385.

Test showed casing collapsed. Further work recommended.

Well No. 5-C, redrill. P 4-1254.

Proposal approved conditionally.

Well No. 9-C, shut off. T 4-550.

Decision withheld pending result of pumping test.

Well No. 9-C, shut off. T 4-666.

Shut-off approved.

Well No. 9-C, redrill. P 4-1452.

Proposal approved with recommendations.

Well No. 10-C, drill. P 4-657.

Proposal approved.

Well No. 10-C, shut off. T 4-743.

Shut-off approved.

Well No. 11-C, drill. P 4-821.

Proposal approved.

Well No. 11-C, shut off. T 4-844.

Shut-off approved.

Well No. 12-C, drill. P 4-1025.

Proposal approved.

Well No. 12-C, shut off. T 4-997.

Test inconclusive. Passed for production test.

Well No. 12-C, shut off. T 4-1124.

Production test showed shut-off satisfactory.

Well No. 13-C, drill. P 4-1183.

Proposal approved.

Well No. 13-C, shut off. T 4-1161.

Passed for production test.

## SECTION 15.

## Southern Pacific Company, Fuel Oil Department.

Well No. 34, drill. P 4-1439.

Proposal answered recommending change in point of shut-off.

Well No. 35, drill. P 4-1441.

Proposal answered with recommendations as to point of shut-off.

Well No. 37, drill. P 4-1442.

Recommended change in point of shut-off.

Well No. 38, drill. P 4-1443.

Recommended change in point of shut-off.

Well No. 39, drill. P 4-1445.

Recommended change in point of shut-off.

Well No. 40, drill. P 4-1433.

Proposal approved.

Well No. 41, drill. P 4-1435.

Recommended change in point of shut-off.

Well No. 45, drill. P 4-1434.

Proposal approved.

Well No. 46, drill. P 4-1436.

Proposal approved.

Well No. 47, drill. P 4-1437.

Proposal approved.

Well No. 48, drill. P 4-1438.

Proposal approved.

## Potter Oil Company.

Well No. 27, drill. DD-911.

Proposal approved.

## Potter Oil Co.—Continued.

Well No. 27, shut off. T 4-631.

Shut-off approved.

## Midway Peerless Oil Company.

Well No. 6, redrill. P 4-601.

Proposal approved.

Well No. 12, redrill. P 4-817.

Proposal approved.

Well No. 15, shut off. T 4-532.

Shut-off approved.

Water well, drill. P 4-877.

Proposal approved.

## Manley &amp; McGinn.

Well No. 5, redrill. P 4-1175.

Proposal approved conditionally.

Well No. 6, drill. P 4-517.

Proposal approved.

## SECTION 21.

## State Consolidated Oil Company.

Well No. 5, shut off. T 4-529.

New shut-off recommended.

Well No. 5, shut off. T 4-737.

Shut-off rejected.

Well No. 5, shut off. T 4-1223.

Approval withheld pending receipt of records.

## SECTION 22.

## C. C. M. O. Co. (Chanslor-Canfield-Midway Oil Company).

Well No. 1, deepen. P 4-970.

Proposal approved conditionally.

Well No. 3, alter casing. P 4-1186.

Proposal approved.

## SECTION 23.

## Tumbador Oil Company.

Well No. 14, drill. P 4-611.

Proposal approved.

## Rock Oil Company.

Well No. 1, special test. T 4-673.

Fluid level determined.

Well No. 2, special test. T 4-558.

Fluid level determined.

Well No. 2, special test. T 4-608.

Fluid level determined.

Well No. 2, shut off. D-935.

Test inconclusive.

Well No. 4, special test. T 4-557.

Fluid level determined with tubing in hole.

Well No. 4, special test. T 4-836.

Fluid level determined.

Well No. 7, special test. T 4-682.

Fluid level determined.

Well No. 8, special test. T 4-586.

Fluid level determined.

## SECTION 24.

## Brookshire Oil Company.

Well No. 5, special test. T 4-513.

Fluid level determined.

Well No. 7, special test. T 4-570.

Fluid level determined.

## SECTION 25.

## Visalia Midway Oil Company.

Well No. 4, deepen. P 4-663.

Proposal rejected; recommended that company submit new proposal.

Well No. 4, deepen. P 4-719.

Proposal approved conditionally.

Well No. 6, shut off. T 4-650.

Test unsatisfactory.

Well No. 6, plug. P 4-731.

Proposal approved.

Well No. 7, special test. T 4-785.

Fluid level and depth of hole determined..

## Recovery Oil Company.

Well No. 7, drill. P 4-1405.

Proposal approved conditionally.

Well No. 7, shut off. T 4-1383.

Shut-off approved.

## American Oilfields Company.

Well No. 1, special test. T 4-627.

Fluid level determined.

Well No. 2, special test. T 4-626.

Fluid level determined.

## SECTION 26.

## State Consolidated Oil Company.

Well No. 16, drill. P 4-738.

Proposal approved conditionally.

Well No. 16, shut off. T 4-1020.

Shut-off approved conditionally.

Well No. 17, drill. P 4-1139.

Recommended change in point of shut-off.

## Reward Oil Company.

Well No. 2, redrill. P 4-583.

Proposal approved.

Well No. 4, shut off. T 4-801.

Shut-off rejected.

Well No. 4, shut off. T 4-930.

Approval withheld.

Well No. 5, drill. P 4-600.

Proposal approved.

Well No. 5, shut off. T 4-732.

Approval withheld.

Well No. 6, shut off. T 4-902.

Decision withheld.

Well No. 6, shut off. T 4-1005.

Decision withheld.

Well No. 7, shut off. T 4-1085.

Decision withheld.

Well No. 7, shut off. T 4-1148.

Test inconclusive.

Well No. 7, shut off. T 4-1150.

Shut-off rejected.

Well No. 7, special test. T 4-1187.

Fluid level determined.

Well No. 7, shut off. T 4-1214.

Shut-off rejected.

Well No. 7, special test. T 4-1232.

Fluid level determined.

Well No. 8, drill. P 4-1173.

Approval withheld.

## Reward Oil Co.—Continued.

Well No. 8, shut off. T 4-1110.

Decision withheld.

Well No. 8, shut off. T 4-1202.

Decision withheld.

Well No. 8, shut off. T 4-1205.

Decision withheld.

Well No. 8, special test. T 4-1278.

Witnessed hole being cleaned out.

Well No. 8, redrill. P 4-1447.

Proposal answered, with recommendations.

Well No. 9, drill. P 4-1174.

Consideration withheld, pending receipt of elevation of well.

Well No. 9, shut off. T 4-1272.

Decision withheld.

Well No. 9, shut off. T 4-1320.

Test inconclusive.

Well No. 9, shut off. T 4-1322.

Test inconclusive.

Well No. 9, shut off. T 4-1323.

Test inconclusive; another test recommended.

Well No. 9, shut off. T 4-1334.

Test inconclusive; another test recommended.

Well No. 9, shut off. T 4-1346.

Decision withheld.

## Pyramid Oil Co.

Well No. 1, abandon. P 4-750.

Proposal answered, with complete specifications for abandonment.

Well No. 1, special test. T 4-741.

Test resulted in modification of method of abandonment.

Well No. 1, special test. T 4-758.

Fluid level determined and mudding witnessed.

Well No. 1, special test. T 4-763.

Test to determine result of mudding.

Well No. 1, special test. T 4-794.

Mudding approved.

Well No. 1, special test. T 4-837.

Plugging approved.

Well No. 1, special test. T 4-840.

Plugging approved.

Well No. 1, special test. T 4-849.

Plugging approved.

Well No. 1, special test. T 4-850.

Mudding approved.

Well No. 1, special test. T 4-859.

Plugging approved.

Well No. 3, abandoned. P 4-724.

Proposal answered, with complete specifications for abandonment.

Well No. 3, special test. T 4-706.

Fluid level and depth of hole determined.

Well No. 12, drill. P 4-1157.

Proposal approved.

Well No. 12, shut off. T 4-1087.

Test inconclusive.

Well No. 12, shut off. T 4-1093.

Shut-off approved.

Well No. 13, drill. P 4-985.

Proposal answered, with recommendations.

## Pyramid Oil Co.—Continued.

Well No. 13, shut off. T 4-940.

Shut-off approved.

Well No. 14, drill. P 4-1326.

Proposal approved, conditionally.

Well No. 14, shut off. T 4-1296.

Shut-off approved.

## Mocal Oil Co.

Well No. 6, drill. P 4-732.

Proposal approved, conditionally.

Well No. 6, shut off. T 4-795.

Shut-off approved.

Well No. 6, redrill. P 4-1468.

Proposal approved.

Well No. 7, drill. P 4-1130.

Proposal approved.

Well No. 7, shut off. T 4-1157.

Shut-off approved.

Well No. 8, drill. P 4-1257.

Proposal approved, conditionally.

Well No. 8, shut off. T 4-1221.

Shut-off approved.

## General Petroleum Corporation.

Well No. 4, special test. T 4-556.

Fluid level determined.

## El Camino Oil and Development Co.

Well No. 23, drill. P 4-811.

Proposal approved, conditionally.

Well No. 23, shut off. T 4-830.

Proposal approved.

Well No. 24, drill. P 4-666.

Proposal approved.

Well No. 24, shut off. RT 4-720.

Shut-off approved.

## Jos. B. Dabney Oil Co.

Well No. 8, abandon. P 4-1488.

Reported work done without the notice to this department. Approval withheld.

Well No. 9, drill. P 4-1432.

Proposal rejected, pending receipt of signed copies of log.

Well No. 9, drill. P 4-1483.

Approved, conditionally.

## Combined Oil Co.

Well No. 1, shut off. T 4-841.

Decision withheld.

Well No. 1, shut off. T 4-919.

Approval withheld, pending investigation of territory.

Well No. 2, drill. P 4-1132.

Proposal approved.

Well No. 2, shut off. T 4-1142.

Decision withheld, pending investigation of territory.

Well No. 2, shut off. T 4-1201.

Test inconclusive.

Well No. 2, shut off. T 4-1207.

Decision withheld, pending investigation of this territory

Well No. 3, drill. P 4-1424.

Proposal approved.

## Chanslor-Canfield Midway Oil Co.

Well No. 3, shut off. T-549.

Shut-off approved.

Well No. 3, redrill. P 4-803.

Proposal approved.

Well No. 7, shut off. T 4-510.

Shut-off approved.

Well No. 9, shut off. T 4-567.

Passed for pumping test.

Well No. 9, production test. T 4-755.

Decision deferred.

Well No. 10, shut off. T 4-829.

Shut-off approved.

Well No. 11, shut off. T 4-691.

Shut-off approved.

Well No. 12, shut off. T 4-643.

Shut-off approved.

Well No. 13, shut off. T 4-978.

Passed for production test.

Well No. 14, shut off. T 4-916.

Shut-off approved.

Well No. 15, shut off. T 4-664.

Shut-off approved.

Well No. 16, deepen. P 4-713.

Proposal approved, with recommendations.

Well No. 16, redrill. P 4-1114.

Proposal approved, with recommendations.

Well No. 17, abandon. P 4-617.

Proposal approved.

Well No. 17, redrill. P 4-733.

Proposal approved, with recommendations.

Well No. 17, abandon. P 4-843.

Proposal approved.

Well No. 17-A, drill. P 4-883.

Proposal approved, with recommendations.

Well No. 17-A, shut off. T 4-895.

Shut-off approved.

Well No. 18, shut off. T 4-652.

Passed for production test.

Well No. 19, shut off. T 4-548.

Passed for production test.

Well No. 19, shut off. T 4-964.

Shut-off rejected, with recommendations.

Well No. 20, shut off. T 4-615.

Passed for production test.

Well No. 20, production test. T 4-1122.

Decision withheld.

Well No. 21, shut off. T 4-776.

Passed for production test.

Well No. 21, production test. T 4-1123.

Decision withheld.

Well No. 22, shut off. T 4-748.

Shut-off approved.

## California Star Oil Co.

Well No. 1, redrill. P 4-1074.

Decision withheld, pending pumping test.

Well No. 4, redrill. P 4-716.

Proposal approved.

## California Star Oil Co.—Continued.

Well No. 5, redrill. DD-912.

Proposal approved.

Well No. 6, redrill. P 4-752.

Proposal approved.

Well No. 7, redrill. P 4-737.

Proposal approved.

Well No. 8, redrill. P 4-771.

Proposal approved, conditionally.

Well No. 8, redrill. P 4-1112.

Proposal approved.

Well No. 9, redrill. P 4-1043.

Proposal approved.

Well No. 9, shut off. T 4-1127.

Proposal approved.

Well No. 9, redrill. P 4-1492.

Proposal approved.

## A. &amp; J. Oil Co.

Well No. 4, redrill. P 4-1250.

Proposal approved, conditionally.

Well No. 5, redrill. P 4-1041.

Consideration withheld, pending receipt of signed copies of log.

Well No. 5, redrill. P 4-1052.

Proposal approved.

## SECTION 27.

## International Oil Co.

Well No. 1, abandon. P 4-1282.

Decision withheld, pending bailing test.

Well No. 1, shut off. T 4-1219.

Shut-off approved.

## Chanslor-Canfield Midway Oil Co.

Well No. 7, drill. P 4-971.

Proposal approved.

Well No. 7, shut off. T 4-1055.

Shut-off approved.

Well No. 8, drill. P 4-919.

Proposal approved.

Well No. 8, shut off. T 4-900.

Shut-off approved.

Well No. 9, drill. P 4-802.

Proposal approved, conditionally.

Well No. 9, shut off. T 4-833.

Shut-off approved.

Well No. 10, drill. P 4-1090.

Proposal approved.

Well No. 10, shut off. T 4-1017.

Shut-off approved.

Well No. 11, drill. P 4-1320.

Proposal approved.

Well No. 11, shut off. P 4-1289.

Test inconclusive.

Well No. 12, drill. P 4-1272.

Proposal approved.

Well No. 12, shut off. T 4-1254.

Shut-off approved.

Well No. 13, drill. P 4-1349.

Proposal approved.

## Chanslor-Canfield Midway Oil Co.—Continued.

Well No. 13, shut off. T 4-1318.

Shut-off approved.

Well No. 14, drill. P 4-1451.

Proposal approved.

Well No. 16, drill. P 4-1469.

Proposal approved.

## SECTION 35.

## Chanslor-Canfield Midway Oil Co.

Well No. 13, shut off. T 4-661.

Shut-off approved.

Well No. 13, special test. T 4-707.

Test indicated no water or productive oil sands present.

Well No. 13, abandon. P 4-755.

Proposal answered, with specifications.

## Associated Oil Co.

Well No. 23, redrill. P 4-950.

Proposal approved.

## SECTION 36.

## Chanslor-Canfield Midway Oil Co.

Well No. 17, deepen. P 4-629.

Proposal approved.

Well No. 17, special test. T 4-778.

Cementing approved.

Well No. 17, shut off. T 4-846.

Shut-off approved.

Well No. 26, redrill. P 4-801.

Proposal approved.

Well No. 26, shut off. T 4-759.

Approval withheld, pending receipt of proper records.

Well No. 26, supplementary redrill. P 4-845.

Proposal approved.

Well No. 26, shut off. T 4-817.

Shut-off approved.

Well No. 29, shut off. T 4-610.

Shut-off approved.

Well No. 33, shut off. T 4-547.

Shut-off approved.

Well No. 34, supplementary drill. P 4-690.

Proposal approved, conditionally.

Well No. 34, supplementary redrill. P 4-691.

Proposal approved.

Well No. 34, shut off. P 4-693.

Shut-off approved.

## American Oilfields Co.

Well No. 5, redrill. P 4-794.

Proposal approved.

Well No. 33, redrill. P 4-587.

Proposal answered, with recommendations.

Well No. 33, shut off. T 4-734.

Approval withheld.

Well No. 33, deepen. P 4-1058.

Proposal approved, conditionally.

Well No. 33, deepen. P 4-1164.

Proposal approved, conditionally.

Well No. 33, redrill. P 4-1233.

Proposal approved, with recommendations.

## American Oilfields Co.—Continued.

- Well No. 43, redrill. P 4-795.  
Proposal approved.  
Well No. 55, redrill. P 4-1028.  
Proposal rejected.  
Well No. 55, redrill. P 4-1420.  
Proposal approved.  
Well No. 57, redrill. P 4-1002.  
Proposal approved.  
Well No. 75, deepen. P 4-710.  
Proposal approved.  
Well No. 76, redrill and deepen. P 4-1201.  
Proposal approved, conditionally.  
Well No. 92, deepen. P 4-1102.  
Approval withheld.  
Well No. 98, redrill. P 4-874.  
Proposal approved.  
Well No. 101, deepen. P 4-806.  
Proposal approved, conditionally.

T. 31 S., R. 23 E., M.D.B. &amp; M.

## SECTION 19.

## Calidon Petroleum Syndicate.

- Well No. 2, redrill. P 4-1115.  
Proposal approved.  
Well No. 3, shut off. D-926.  
Shut-off approved.

## Union Oil Company of California.

- Well No. 3, "Midway Royal," shut off. T 4-684.  
Decision withheld, pending developments.  
Well No. 3, "Midway Royal," supplementary drill. P 4-1129.  
Proposal approved.  
Well No. 3, "Midway Royal," shut off. T 4-1165.  
Shut-off approved.  
Well No. 3, "Midway Royal," abandon. P 4-1491.  
Proposal approved, with recommendations.

## SECTION 20.

## United Oil Co.

- Well No. 20, shut off. T 4-692.  
Decision withheld.  
Well No. 20, shut off. T 4-705.  
Test inconclusive.

## SECTION 22.

## Standard Oil Co.

- Well No. 6, redrill. P 4-1301.  
Proposal approved, conditionally.

## SECTION 25.

## Southern Pacific Company, Fuel Oil Department.

- Well No. 14, shut off. T 4-579.  
Test inconclusive.  
Well No. 15, shut off. T 4-746.  
Shut-off approved.  
Well No. 15, supplementary drill. P 4-809.  
Proposal approved.  
Well No. 17, drill. P 4-707.  
Proposal approved.

## Southern Pacific Co., Fuel Oil Department--Continued.

Well No. 19, drill. P 4-706.

Proposal approved.

Well No. 21, drill. P 4-692.

Proposal approved.

Well No. 21, shut-off. T 4-708.

Shut-off approved.

Well No. 28, redrill. P 4-1462.

Proposal approved.

## SECTION 26.

## Standard Oil Co.

Well No. 2, deepen. P 4-1169.

Proposal approved.

Well No. 13, deepen. P 4-537.

Proposal approved.

Well No. 18, shut-off. T 4-1084.

Shut-off approved.

## SECTION 27.

## Southern Pacific Company, Fuel Oil Department.

Well No. 5, drill. P 4-893.

Proposal approved.

Well No. 31, shut-off. T 4-1015.

Shut-off approved.

## Midway Gas Co.

Well No. 27, shut-off. T 4-726.

Shut-off approved.

Well No. 59, drill. P 4-1345.

Proposal approved.

## SECTION 28.

## Consolidated Mutual Oil Co.

Well No. 15, drill. P 4-1071.

Proposal approved.

## SECTION 30.

## Associated Oil Co.

Well No. 2, redrill. P 4-534.

Proposal approved conditionally.

Well No. 2, supplementary redrill. P 4-946.

Proposal approved.

Well No. 2, supplementary abandon. P 4-1045.

Proposal answered with specifications for abandonment.

## Consolidated Mutual Oil Co.

Well No. 6, deepen. P 4-1248.

Proposal approved.

Well No. 6, shut-off. T 4-1179.

Test inconclusive.

Well No. 6, shut off. T 4-1195.

Test satisfactory.

Well No. 6, special test. T 4-1210.

Test inconclusive.

Well No. 6, special test. T 4-1220.

Shut-off approved conditionally.

## SECTION 31.

## Standard Oil Co., "Eagle Creek."

Well No. 4, redrill. P 4-1284.

Proposal approved conditionally.

## Standard Oil Co., "Eagle Creek"—Continued.

Well No. 5, redrill. P 4-918.

Proposal approved.

Well No. 5, supplementary redrill. P 4-1055.

Proposal approved conditionally.

Well No. 11, redrill. P 4-1140.

Proposal answered with recommendations.

Well No. 11, redrill. P 4-1453.

Proposal answered with recommendations.

Well No. 11, special test. T 4-1372.

Shoe of 8 $\frac{1}{4}$ " casing located.

Well No. 13, redrill. P 4-1270.

Proposal approved conditionally.

Well No. 19, redrill. P 4-1322.

Proposal approved.

Well No. 19, shut off. T 4-1340.

Fluid level determined.

Well No. 19, shut off. T 4-1341.

Passed for production test.

Well No. 20, shut off. T 4-611.

Shut-off approved.

Well No. 21, abandon. P 4-830.

Proposal answered with specifications for abandonment.

Well No. 22, shut off. T 4-562.

Decision withheld.

Well No. 22, shut off. T 4-660.

Passed for production test.

Well No. 23, drill. P 4-581.

Proposal approved.

Well No. 23, shut off. P 4-633.

Shut-off approved.

Well No. 24, drill. P 4-725.

Proposal approved.

Well No. 25, drill. P 4-726.

Proposal approved.

Well No. 25, shut off. T 4-774.

Shut-off approved.

Well No. 26, drill. P 4-671.

Proposal approved.

Well No. 26, shut off. T 4-733.

Shut-off approved.

Well No. 28, drill. P 4-936.

Proposal approved.

Well No. 28, shut off. T 4-904.

Shut-off approved.

Well No. 29, drill. P 4-1026.

Proposal approved.

Well No. 29, shut off. T 4-1194.

Shut-off approved.

## Eight Oil Co.

Well No. 4, abandon. P 4-834.

Proposal rejected.

Well No. 4, supplementary abandon. P 4-1411.

Proposal answered with specifications.

Well No. 5, abandon. P 4-835.

Proposal rejected.

## Eight Oil Co.—Continued.

Well No. 5, supplementary abandon. P 4-1412.

Proposal answered with specifications.

Well No. 8, abandon. P 4-836.

Proposal rejected.

Well No. 8, supplementary abandon. P 4-1406.

Proposal answered with specifications.

Well No. 9, abandon. P 4-837.

Proposal rejected.

Well No. 16, abandon. P 4-838.

Proposal rejected.

Well No. 18, abandon. P 4-839.

Proposal rejected with recommendations.

Well No. 18, supplementary abandon. P 4-892.

Acknowledged receipt of notice that well would not be abandoned.

## Chanslor-Canfield Midway Oil Co.

Well No. 9, redrill. P 4-573.

Proposal approved.

Well No. 20, abandon. P 4-776.

Proposal answered with recommendations.

Well No. 21, shut off. T 4-522.

Shut-off approved.

Well No. 25, shut off. T 4-524.

Shut-off approved.

Well No. 28, shut off. T 4-507.

Shut-off approved.

Well No. 29, redrill. P 4-1465.

Proposal approved with recommendations.

Well No. 31, redrill. P 4-754.

Proposal approved.

## SECTION 32.

## California Midway Oil Co.

Well No. 10, shut off. T 4-808.

Passed for production test.

Well No. 10, production test. T 4-984.

Condition unsatisfactory.

Well No. 10, deepen. P 4-1214.

Proposal approved.

## Alaska Pioneer Oil Co.

Well No. 8, shut off. T 4-506.

Further work recommended.

Well No. 8, deepen. P 4-593.

Proposal approved.

Well No. 8, shut off. T 4-623.

Shut-off approved.

Well No. 8, shut-off. T 4-657.

Test showed no productive oil measures in hole below 64".

Well No. 8, supplementary deepen. P 4-1215.

Proposal approved.

Well No. 8, shut off. T 4-1335.

Shut-off approved.

## General Petroleum Corporation.

Well No. 6, abandon. P 4-990.

Proposal answered with specifications.

Well No. 6, supplementary abandon. P 4-1038.

Proposal answered with additional specifications.

## SECTION 34.

Union Oil Company of California.

Well No. 7, abandon. P 4-756.

Proposal answered with specifications.

Well No. 7, revised proposal to abandon. P 4-783.

Proposal approved.

Well No. 9, abandon. P 4-1042.

Proposal rejected.

## SECTION 35.

Southern Pacific Co., Fuel Oil Department.

Well No. 6, redrill. P 4-744.

Proposal approved.

Well No. 6, supplementary redrill. P 4-856.

Proposal revoked.

Well No. 6, shut off. T 4-824.

Shut-off approved.

Well No. 54, drill. P 4-693.

Proposal approved.

Well No. 54, shut off. T 4-749.

Shut-off approved.

Well No. 54, deepen. P 4-1156.

Proposal approved.

Well No. 54, deepen. P 4-1224.

Proposal approved conditionally.

Well No. 56, drill. P 4-694.

Proposal approved.

Well No. 56, shut off. T 4-1104.

Shut-off approved.

Well No. 57, drill. P 4-695.

Proposal approved.

Well No. 57, shut off. T 4-798.

Shut-off approved.

Well No. 58, drill. P 4-696.

Proposal approved.

Well No. 58, shut off. T 4-954.

Test unsatisfactory.

Well No. 58, shut off. T 4-955.

Shut-off approved.

Well No. 60, drill. P 4-697.

Proposal approved.

Well No. 60, shut off. T 4-927.

Decision withheld.

Well No. 61, drill. P 4-698.

Proposal approved.

Well No. 61, shut-off. T 4-1306.

Shut-off approved.

## SECTION 36.

Standard Oil Co.

Well No. 11, redrill. P 4-1470.

Approved conditionally.

Well No. 11, shut off. T 4-1380.

Shut-off satisfactory.

Well No. 14, supplementary redrill. P 4-823.

Proposal approved with recommendations.

Well No. 14, shut off. T 4-947.

Decision withheld, pending additional tests.

## Standard Oil Co.—Continued.

- Well No. 14, shut off. T 4-949.  
Decision withheld pending receipt of records.
- Well No. 14, shut off. T 4-995.  
Shut-off approved conditionally.
- Well No. 25, shut off. T 4-559.  
Shut-off approved.
- Well No. 27, redrill. P 4-824.  
Proposal approved conditionally.
- Well No. 27, shut off. T 4-847.  
Shut-off approved.
- Well No. 27, supplementary deepen. P 4-1004.  
Proposal approved conditionally.
- Well No. 29, redrill. P 4-1314.  
Proposal approved conditionally.
- Well No. 43, redrill. P 4-1313.  
Proposal approved.
- Well No. 44, redrill. P 4-1091.  
Proposal approved conditionally.
- Well No. 44, shut off. T 4-1031.  
Shut-off approved with recommendations.
- Well No. 44, supplementary redrill. P 4-1198.  
Proposal approved, with recommendations.
- Well No. 44, shut off. T 4-1283.  
Test inconclusive.
- Well No. 44, shut off. T 4-1284.  
Shut-off unsatisfactory.
- Well No. 44, supplementary redrill. P 4-1419.  
Proposal approved conditionally.
- Well No. 48, deepen. P 4-1138.  
Proposal approved conditionally.
- Well No. 49, deepen. P 4-1171.  
Proposal approved, conditionally.
- Well No. 52, deepen. DD-909.  
Proposal approved.
- Well No. 52, redrill. P 4-818.  
Proposal approved.
- Well No. 52, shut off. T 4-1066.  
Test inconclusive.
- Well No. 52, shut off. T 4-1077.  
Shut-off approved.
- Well No. 52, redrill. P 4-1400.  
Decision withheld pending receipt of records.
- Well No. 52, redrill. P 4-1444.  
Proposal approved, with recommendations.
- Well No. 55, redrill. P 4-579.  
Proposal approved.
- Well No. 55, shut off. T 4-685.  
Passed for production test.
- Well No. 55, deepen. P 4-1155.  
Proposal approved, conditionally.
- Well No. 55, redrill. P 4-1401.  
Decision withheld, pending receipt of data.
- Well No. 55, redrill. P 4-1446.  
Proposal rejected.
- Well No. 55, supplementary redrill. P 4-1481.  
Proposal answered, with recommendations.

## The Petroleum Co.—Continued.

Well No. 56, redrill. P 4-872.

Decision withheld, pending receipt of signed copies of log.

Well No. 56, supplementary redrill. P 4-914.

Proposal answered, with recommendations.

Well No. 57, shut off. T 4-592.

Shut-off approved.

Well No. 58, drill. P 4-596.

Proposal answered, recommendations.

Well No. 58, shut off. T 4-687.

Shut-off approved.

Well No. 59, drill. P 4-652.

Proposal approved.

Well No. 59, shut off. T 4-760.

Test inconclusive.

Well No. 59, shut off. T 4-764.

Shut-off approved.

Well No. 60, drill. P 4-658.

Proposal approved.

Well No. 60, shut off. T 4-754.

Shut-off approved.

Well No. 60, redrill. P 4-1089.

Decision withheld, pending receipt of records.

Well No. 60, supplementary redrill. P 4-1137.

Proposal approved.

Well No. 61, drill. P 4-1123.

Proposal approved.

Well No. 61, shut off. T 4-1248.

Passed for production test.

Well No. 62, drill. P 4-1122.

Proposal approved.

Well No. 62, supplementary drill. P 4-1303.

Proposal approved.

Well No. 62, shut off. T 4-1273.

Shut-off approved.

Well No. 62, redrill. P 4-1430.

Proposal approved.

T. 31 S., R. 24 E., M.D.B. &amp; M.

## SECTION 31.

## Southern Pacific Company, Fuel Oil Department.

Well No. 8, drill. P 4-515.

Proposal approved.

Well No. 8, shut off. T 4-809.

Shut-off approved.

Well No. 8, redrill. P 4-1237.

Proposal approved.

Well No. 59, drill. P 4-1431.

Proposal answered, with recommendations.

T. 32 S., R. 23 E., M.D.B. &amp; M.

## SECTION 1.

## Southern Pacific Company, Fuel Oil Department.

Well No. 1, deepen. P 4-813.

Proposal approved.

Well No. 41, shut off. T 4-638.

Shut-off approved.

Well No. 41, redrill. P 4-1152.

Decision withheld, pending receipt of signed copies of log.

## Southern Pacific Co., Fuel Oil Department—Continued.

Well No. 41, redrill. P 4-1200.

Proposal approved.

Well No. 56, shut off. T 4-625.

Shut-off approved.

Well No. 57, shut off. D-933.

Shut-off approved.

Well No. 58, shut off. T 4-542.

Shut-off approved.

## SECTION 2.

## North American Oil Consolidated.

Well No. 9, redrill. P 4-1057.

Proposal approved, conditionally.

Well No. 9, shut off. T 4-1025.

Shut-off approved.

Well No. 10, shut off. T 4-583.

Shut-off approved.

Well No. 14, redrill. P 4-1363.

Proposal approved, conditionally.

Well No. 14, supplementary redrill. P 4-1428.

Proposal approved.

Well No. 15, drill. P 4-1367.

Proposal answered, with recommendations.

Well No. 15, shut off. T 4-1360.

Shut-off approved, conditionally.

## SECTION 3.

## Southern Pacific Company, Fuel Oil Department.

Well No. 6, drill. P 4-799.

Proposal approved.

## SECTION 4.

## Standard Oil Company, "Equitable."

Well No. 10, drill. P 4-639.

Proposal approved.

Well No. 10. P 4-997.

Proposal approved.

Well No. 10 (new), drill. P 4-998.

Proposal approved.

Well No. 10, shut off. T 4-1038.

Shut-off approved.

Well No. 11, drill. P 4-810.

Proposal approved, conditionally.

Well No. 11, shut off. T 4-892.

Shut-off approved.

Well No. 11, redrill. P 4-1307.

Proposal approved, conditionally.

Well No. 12, drill. P 4-1457.

Proposal answered, with recommendations as to point of shut-off.

## General Petroleum Corporation.

Well No. 3, redrill. P 4-1285.

Proposal approved, conditionally.

Well No. 3, supplementary redrill. P 4-1417.

Proposal approved, conditionally.

Well No. 5, redrill. P 4-1479.

Proposal approved.

## SECTION 5.

## St. Lawrence Oil Co.

Well No. 6, abandon. P 4-1458.

Proposal answered, with specifications.

Well No. 8, redrill. P 4-559.

Proposal approved.

## Southern Pacific Company, Fuel Oil Department

Well No. 6, deepen. P 4-1415.

Proposal approved.

Well No. 31, drill. P 4-955.

Proposal approved.

Well No. 31, shut off. T 4-994.

Shut-off approved.

Well No. 32, drill. P 4-953.

Proposal approved.

Well No. 32, shut off. T 4-1016.

Shut-off approved.

Well No. 33, drill. P 4-954.

Proposal approved.

Well No. 33, shut off. T 4-1185.

Shut-off approved.

Well No. 34, drill. P 4-956.

Proposal approved.

Well No. 34, shut off. T 4-1233.

Shut-off approved.

Well No. 35, drill. P 4-957.

Proposal approved.

Well No. 35, shut off. T 4-1307.

Test inconclusive.

Well No. 35, shut off. T 4-1327.

Decision deferred.

Well No. 36, drill. P 4-958.

Proposal approved.

Well No. 37, drill. P 4-959.

Proposal approved.

Well No. 37, shut off. T 4-1178.

Shut-off approved.

Well No. 37, supplementary drill. P 4-1364.

Proposal approved.

Well No. 37, shut off. T 4-1310.

Shut-off approved.

## Midway Five Oil Co.

Well No. 1, abandon. P 4-614.

Proposal answered, with specifications.

## SECTION 6.

## Chanslor-Canfield Midway Oil Co.

Well No. 16, redrill. P 4-1274.

Proposal approved.

Well No. 40, redrill. P 4-1158.

Proposal answered, with recommendations.

Well No. 40, shut off. T 4-1105.

Shut-off approved.

Well No. 48, redrill. P 4-917.

Proposal approved.

Well No. 54, shut off. T 4-600.

Shut-off approved.

Well No. 54, redrill. P 4-728.

Proposal approved.

## Chapman-Confield Midway Oil Co.—Continued.

Well No. 55, shut off. T 4-690.

Shut-off approved.

Well No. 57, shut off. T 4-537.

Shut-off approved.

Well No. 62, shut off. D-934.

Shut-off approved.

## United Oil Co.

Well No. 6, shut off. T 4-531.

Shut-off approved.

Well No. 6, shut off. T 4-588.

Passed for pumping test.

Well No. 6, alter casing. P 4-643.

Proposal approved.

Well No. 6, shut off. T 4-644.

Approval withheld.

Well No. 6, production test. T 4-941.

Condition unsatisfactory; recommended tests to locate source of water.

Well No. 10, drill. P 4-1181.

Proposal approved, conditionally.

Well No. 10, shut off. T 4-1226.

Shut-off satisfactory.

Well No. 10, shut off. T 4-1227.

Shut-off satisfactory.

Well No. 10, special test. T 4-1270.

Sand tested carried no water.

Well No. 10, special test. T 4-1271.

Strata tested not water-bearing.

Well No. 10, production test. T 4-1345.

Condition unsatisfactory.

Well No. 10, production test. T 4-1358.

Condition unsatisfactory.

## SECTION 7.

## Stratton Water Co.

Well No. 2, abandon. P 4-1083.

Proposal answered, with specifications.

Well No. 3, abandon. P 4-1084.

Proposal answered, with specifications.

Well No. 4, abandon. P 4-1085.

Proposal answered, with specifications.

Well No. 5, abandon. P 4-717.

Proposal answered, with specifications.

Well No. 5, special test. T 4-871.

Mudding rejected.

Well No. 5, special test. T 4-901.

Mudding approved.

Well No. 5, special test. T 4-956.

Shooting of well approved.

Well No. 5, special test. T 4-957.

Plugging approved.

Well No. 5, shut off. T 4-958.

Test inconclusive.

Well No. 5, special test. T 4-965.

Shooting approved.

## SECTION 8.

## Hale-McLeod Oil Co.

Well No. 15, deepen. P 4-1097.

Proposal approved, conditionally.

## Hale-McLeod Oil Co.-Continued.

- Well No. 17, redrill. P 4-820.  
Proposal approved.  
Well No. 20, abandon. P 4-962.  
Decision withheld, pending receipt of signed copies of log.  
Well No. 20, abandon. P 4-988.  
Proposal approved.  
Well No. 21, drill. P 4-960.  
Proposal approved.  
Well No. 21, shut off. T 4-899.  
Shut-off approved.  
Well No. 22, drill. P 4-1189.  
Proposal approved.  
Well No. 22, shut off. T 4-1145.  
Test inconclusive.  
Well No. 22, shut off. T 4-1206.  
Shut-off approved.  
Well No. 23, drill. P 4-1426.  
Proposal approved.

## Chanslor-Canfield Midway Oil Co.

- Well No. 26, deepen. P 4-630.  
Proposal approved, conditionally.  
Well No. 26, supplementary deepen. P 4-1088.  
Proposal answered, with recommendations.  
Well No. 26, special test. T 4-1000.  
Cementing approved.  
Well No. 26, supplementary deepen. P 4-1212.  
Proposal answered, with recommendations.  
Well No. 26, shut off. T 4-1141.  
Shut-off approved, with reservations.  
Well No. 27, drill. P 4-1044.  
Proposal approved.  
Well No. 27, shut off. T 4-1139.  
Passed for production test.  
Well No. 28, drill. P 4-659.  
Proposal approved.  
Well No. 28, shut off. T 4-718.  
Test inconclusive.  
Well No. 28, production test. T 4-1125.  
Shut-off approved.  
Well No. 29, drill. P 4-920.  
Proposal approved.  
Well No. 29, shut off. T 4-922.  
Test inconclusive.  
Well No. 29, production test. T 4-1235.  
Shut-off approved.  
Well No. 30, drill. P 4-814.  
Proposal approved.  
Well No. 30, shut off. T 4-1218.  
Shut-off approved.  
Well No. 31, drill. P 4-1241.  
Proposal approved.  
Well No. 31, shut off. T 4-1250.  
Shut-off approved.  
Well No. 32, drill. P 4-1396.  
Proposal approved.  
Well No. 34, drill. P 4-1116.  
Proposal approved.

## Chanslor-Canfield Midway Oil Co.—Continued.

- Well No. 34, shut off. T 4-1113.  
 Test inconclusive.
- Well No. 34, shut off. T 4-1115.  
 Shut-off unsatisfactory.
- Well No. 34, supplementary drill. P 4-1257.  
 Proposal approved, with recommendations.
- Well No. 34, shut off. T 4-1239.  
 Shut-off approved for prospecting ahead.
- Well No. 34, supplementary drill. P 4-1299.  
 Proposal approved.
- Well No. 34, shut off. T 4-1293.  
 Another test recommended.
- Well No. 34, supplementary drill. P 4-1423.  
 Proposal approved.
- Well No. 34, shut off. T 4-1384.  
 Shut-off approved.
- Well No. 35, drill. P 4-1342.  
 Proposal approved.
- Well No. 35, shut off. T 4-1370.  
 Shut-off approved.
- Well No. 36, drill. P 4-1346.  
 Proposal approved.
- Well No. 36, supplementary drill. P 4-1354.  
 Proposal approved.
- Well No. 36, shut off. T 4-1350.  
 Shut-off approved.

## SECTION 9.

## Chanslor-Canfield Midway Oil Co.

- Well No. 19, abandon. P 4-777.  
 Proposal answered, with recommendations.
- Well No. 19, supplementary abandon. P 4-1024.  
 Proposal approved, conditionally.
- Well No. 19, shut off. T 4-1095.  
 Test inconclusive.
- Well No. 19, shut off. T 4-1099.  
 Plugging approved.
- Well No. 19, supplementary plug. P 4-1245.  
 Proposal answered, with recommendations.

## SECTION 10.

## Standard Oil Co.

- Well No. 6, redrill. P 4-1302.  
 Proposal approved.
- Well No. 6, shut off. T 4-1304.  
 Test inconclusive.
- Well No. 6, shut off. T 4-1305.  
 Shut-off unsatisfactory. Recommended tests to locate source of water.
- Well No. 9, shut off. T 4-533.

## Chanslor-Canfield Midway Oil Co.

- Well No. 4, alter casing. P 4-586.  
 Proposal approved.
- Well No. 4, abandon. P 4-799.  
 Proposal approved, with recommendations.
- Well No. 5, abandon. P 4-778.  
 Proposal answered, with recommendations.
- Well No. 9, abandon. P 4-780.  
 Proposal answered, with recommendations.

## Chanslor-Canfield Midway Oil Co.—Continued.

Well No. 9, abandonment. P 4-1310.

Approval of removal of surface equipment given, with the proviso that well be left in such condition that it may be gone into for further work later if necessary.

## SECTION 14.

## Standard Oil Co.

Well No. 8, redrill. P 4-1054.

Proposal rejected, for not containing provision for protection of oil zone.

Well No. 8, shut off. T 4-1106.

Shut-off rejected.

Well No. 8, supplementary redrill. P 4-1228.

Proposal rejected.

Well No. 8, supplementary redrill. P 4-1261.

Representatives of the companies in this locality were called in conference by the State Oil and Gas Supervisor for consideration of the conditions of this well. It was the opinion of these representatives that the condition of this well might result in no particular damage to the surrounding territory. However this decision was not to establish a precedent of low shut-off in this locality. It was further agreed that it be definitely understood that in the future all such proposals were to be presented to this Bureau by the companies through their geological departments.

The above conference led to an agreement by the geologists of the companies concerned, that they work up and submit a report on the underground conditions in this locality. This report has not, as yet, been submitted.

In accordance with the above decision, the proposal to drill the well in without changing the shut-off was approved.

## Union Oil Co., "Regal."

Well No. 4, shut off. T 4-526.

Shut-off rejected.

Well No. 4, shut off. T 4-527.

Another shut-off recommended.

Well No. 4, shut off. T 4-642.

Shut-off approved.

Well No. 9, drill. P 4-757.

Proposal approved.

Well No. 9, shut off. T 4-1045.

Shut-off approved.

Well No. 9, shut off. T 4-1162.

Test indicated that 10" shut-off was not leaking. Additional tests to locate source of water recommended.

Well No. 9, shut off. T 4-1192.

Decision deferred, pending production test.

Well No. 9, redrill. P 4-487.

Proposal approved, with recommendations.

## SECTION 15.

## Spellacy and Thompson Oil Co.

Well No. 1, redrill. P 4-772.

Proposal approved, conditionally.

Well No. 1, redrill. P 4-869.

Proposal approved, with recommendations.

Well No. 1, shut off. T 4-907.

Passed for production test.

Well No. 1, abandon. P 4-1281.

Proposal answered, with specifications.

Well No. 1, special test. T 4-1268.

Placing of cement plug approved.

## Spellacy and Thompson Oil Co.—Continued.

Well No. 1, shut off. T 4-1290.

Another test recommended.

Well No. 1, special test. T 4-1332.

Mudding witnessed.

Well No. 1, special test. T 4-1363.

Placing of cement plug approved.

Well No. 1, special test. T 4-1364.

Recommended making further attempts to mud hole.

Well No. 1, special test. T 4-1379.

Report on attempts at mudding under pressure. Recommended no further mudding be attempted.

## Montana Wyoming Oil Co.

Well No. 2, redrill. P 4-742.

Proposal approved, conditionally.

Well No. 2, redrill. P 4-819.

Proposal approved.

## Empire Gas and Fuel Co.

Well No. 3, abandon. P 4-758.

Proposal answered, with specifications.

Well No. 3, special test. T 4-789.

Shooting approved.

Well No. 3, special test. T 4-792.

Placing of cement plug approved.

Well No. 3, special test. T 4-834.

Placing of cement plug approved.

## Chanslor-Canfield Midway Oil Co.

Well No. 2, drill. P 4-1117.

Proposal approved.

Well No. 2, shut off. T 4-1170.

Shut-off approved.

Well No. 2, redrill. P 4-1365.

Proposal approved.

## SECTION 16.

## North American Oil Consolidated.

Well No. 71, redrill. P 4-518.

Proposal approved, conditionally.

Well No. 71, shut off. T 4-535.

Test showed formations behind water string protected, but those below shoe of water string were open to damage.

## Chanslor-Canfield Midway Oil Co.

Well No. 8, redrill. P 4-1276.

Proposal approved.

Well No. 26, drill. P 4-1449.

Proposal approved.

Well No. 27, drill. P 4-1450.

Proposal approved.

## SECTION 21.

## Chanslor-Canfield Midway Oil Co.

Well No. 13, drill. P 4-866.

Proposal approved.

Well No. 13, shut off. T 4-917.

Shut-off approved.

Well No. 14, drill. P 4-1033.

Proposal approved.

Well No. 14, shut off. T 4-975.

Shut-off approved.

## Chanslor-Canfield Midway Oil Co.—Continued.

Well No. 15, drill. P 4-1179.

Proposal approved.

Well No. 15, shut off. T 4-1234.

Shut-off approved.

Well No. 16, drill. P 4-1344.

Proposal approved.

## SECTION 22.

## General Petroleum Corp.

Well No. 2, abandon. P 4-984.

Proposal answered, with specifications.

## Fairbanks Oil Co.

Well No. 12, shut off. T 4-523.

Shut-off approved.

Well No. 13, shut off. T 4-662.

Shut-off approved.

## F. B. Chapin.

Well No. 4, alter casing. P 4-891.

Decision withheld, pending a bailing test.

Well No. 4, pumping test. T 4-948.

This test as recommended in Report No. P 4-891. Test inconclusive; another recommended.

## Pan-American Petroleum Co., "West 40."

Well No. 3, redrill. P 4-625.

Proposal approved.

Well No. 3, special test. T 4-696.

Witnessed hole open.

Well No. 3, shut off. T 4-703.

Decision withheld.

Well No. 3, shut off. T 4-713.

Passed for production test.

Well No. 3, production test. T 4-814.

Test showed old plugging still efficiently holding water out of oil-bearing formations. Further work recommended.

## SECTION 23.

## Traders Oil Co.

Well No. 71, redrill. P 4-763.

Proposal approved.

Well No. 77, special test. D-911.

Test to locate fluid level. Level found at 892' 6".

Well No. 105, special test. D-925.

Fluid level found at 787'.

Well No. 106, special test. T 4-629.

Fluid level located at 960'.

## Indian and Colonial Development Co.

Well No. 11, redrill. P 4-624.

Proposal approved.

Well No. 11, fluid level test. T 4-783.

Fluid level at 868'.

Well No. 11, shut-off. T 4-852.

On basis of this test recommendations were given for carrying on work.

Well No. 11, special test. T 4-855.

Test to check up formations given on log.

Well No. 11, special test. T 4-868.

Mudding approved.

Well No. 11, special test. T 4-878.

Placing of cement plug approved.

## Indian and Colonial Development Co.—Continued.

Well No. 11, special test. T 4-972.

Mudding approved.

Well No. 11, special test. T 4-973.

Test on final condition of well preparatory to going on with the recommended work.

Well No. 11, special test. T 4-974.

Test to locate shoe of 8½".

Well No. 11, special test. T 4-1052.

Plugging as recommended witnessed and approved. This department recommended that this well be made a producer instead of being abandoned.

## SECTION 24.

## Jameson Oil Co.

Well No. 13, shut-off. T 4-929.

Production test to determine the condition of the well.

Well No 14, deepen. P 4-1029.

Decision withheld pending receipt of information.

Well No. 15, shut-off. T 4-828.

Decision withheld.

Well No. 15, supplementary drill. P 4-859.

Approval withheld pending result of investigation in this territory.

Well No. 15, shut-off. T 4-831.

Final decision withheld.

Well No. 15, test for oil. P 4-1022.

Proposal approved conditionally.

Well No. 15, deepen. P 4-1023.

Proposal approved conditionally.

Well No. 15, deepening. P 4-1275.

Recommended that the company submit a supplementary proposal outlining work to correct conditions at this well.

Well No. 15, deepen. P 4-1340.

Proposal approved conditionally.

Well No. 15, supplementary drill. P 4-1418.

Proposal approved conditionally.

Well No. 17, shut-off. T 4-582.

Shut-off approved.

Well No. 17, shut-off. T 4-827.

Shut-off approved.

Well No. 17, supplementary drill. P 4-858.

Proposal approved.

## SECTION 25.

## Princeton Oil Co.

Well No. 3, redrill. P 4-1187.

Proposal approved with recommendations.

Well No. 3, shut-off. T 4-1147.

Test indeterminate. Recommended the company plug and test for bottom water.

## General Petroleum Corp.

Well No. 34, redrill. P 4-1354.

Proposal approved.

Well No. 43, redrill. P 4-1319.

Proposal approved.

## Cresceus Oil Co.

Well No. 1, deepen and redrill. P 4-1154.

Proposal answered with specifications.

Well No. 7, redrill. P 4-1030.

Proposal approved.

## SECTION 26.

## Wilbert Oil Co.

Well No. 9, drill. P 4-570.

Proposal approved conditionally.

Well No. 10, drill. P 4-1495.

Proposal approved conditionally.

## Mascot Oil Co.

Well No. 3, redrill. P 4-684.

Proposal approved.

Well No. 6, abandon. P 4-831.

Proposal answered with specifications.

Well No. 6, supplementary redrill. P 4-899.

Proposal approved.

Well No. 6, shut-off. T 4-934.

Shut-off approved.

Well No. 17, special test. T 4-1191.

Plugging witnessed.

Well No. 17, redrill. P 4-1278.

Proposal approved.

Well No. 17, special test. T 4-1285.

Report on shooting and plugging with cement.

Well No. 19, redrill. P 4-616.

Proposal approved.

Well No. 34, redrill. P 4-576.

Proposal to pull line and put in screen pipe approved.

## J. M. S. Oil Lease.

Well No. 5, abandon. P 4-870.

Proposal approved.

Well No. 5, abandon. P 4-1478.

Report on abandonment approved.

Well No. 8, drill. P 4-963.

Proposal approved conditionally.

Well No. 8, shut-off. T 4-1002.

Shut-off rejected.

Well No. 8, supplementary drill. P 4-1108.

Proposal approved conditionally.

Well No. 8, supplementary drill. P 4-1141.

Proposal approved.

Well No. 8, special test. T 4-1035.

Test to determine water head.

Well No. 8, special test. T 4-1036.

Test to determine whether or not certain sands are oil bearing. Not oil bearing.

Well No. 8, shut-off. T 4-1086.

Shut-off approved.

## Associated Oil Co.

Well No. 25, redrill. P 4-668.

Proposal approved.

Well No. 42, redrill. P 4-669.

Proposal approved.

Well No. 53, redrill. P 4-670.

Proposal to cut casing approved.

Well No. 58, abandon. P 4-650.

Proposal approved.

## SECTION 35.

## U. G. Wolfe and Associates.

Well No. 1, drill. P 4-654.

Proposal approved provided no top water is found. This department to be notified if top water is encountered, in which case a shut-off above the productive sands will be recommended.

## Associated Oil Co.

Well No. 1, deepen. P 4-709.

Proposal approved.

Well No. 1, shut-off. T 4-738.

No test made.

Well No. 1, shut-off. T 4-804.

Another test recommended.

Well No. 1, shut-off. T 4-811.

Test inconclusive due to plug in casing.

Well No. 1, redrill. P 4-924.

Proposal approved.

Well No. 1, supplementary deepen. P 4-1059.

Decision deferred.

Well No. 1, abandon. P 4-1143.

Proposal answered with specifications.

Well No. 1, shut-off. T 4-1186.

Test indicated cement plug tight.

Well No. 1, special test. T 4-1204.

Test on cement plug in 10" indicated that water below plug was prevented from entering formations above. Further recommendations given.

T. 32 S., R. 24 E., M.D.B. & M.

## SECTION 5.

## Midway Gas Co.

Well No. 57, drill. P 4-876.

Proposal approved.

Well No. 57, shut-off. T 4-969.

Shut-off approved.

## SECTION 7.

## Southern Pacific Company, Fuel Oil Department.

Well No. 32, drill. P 4-516.

Proposal approved.

Well No. 32, shut-off. T 4-694.

Shut-off approved.

Well No. 32, shut-off. T 4-823.

Test indeterminate.

Well No. 32, supplementary drill. P 4-854.

Proposal answered with recommendations.

Well No. 32, supplementary drill. P 4-948.

Proposal approved conditionally.

Well No. 32, shut-off. T 4-887.

Passed for production test.

Well No. 32, production test. T 4-1128.

Shut-off approved.

## SECTION 8.

## Honolulu Consolidated Oil Co.

Well No. 7, deepen. P 4-1027.

Proposal approved conditionally.

## SECTION 9.

## Southern Pacific Company, Fuel Oil Department.

Well No. 1, alter casing. P 4-769.

Proposal answered with recommendations.

Well No. 1, supplementary alter casing. P 4-947.

Proposal approved conditionally.

Well No. 18, shut-off. D-927.

Shut-off approved.

Well No. 50, drill. P 4-699.

Proposal approved.

## Southern Pacific Co., Fuel Oil Department—Continued.

Well No. 50, shut-off. T 4-788.

Shut-off approved.

Well No. 51, drill. P 4-700.

Proposal approved.

Well No. 51, shut-off. T 4-910.

Another test recommended.

Well No. 51, shut-off. T 4-911.

Shut-off approved.

Well No. 52, drill. P 4-701.

Proposal approved.

Well No. 52, shut-off. T 4-786.

Shut-off approved.

Well No. 53, drill. P 4-702.

Proposal approved.

Well No. 53, shut-off. T 4-880.

Shut-off approved.

Well No. 54, drill. P 4-703.

Proposal approved.

Well No. 54, supplementary drill. P 4-1078.

Proposal approved conditionally.

Well No. 54, shut-off. T 4-1012.

Water probably shut off, but due to fact that the casing was first reported cemented at 2205', and later reported cemented at 2188', based on measurements of drill pipe after drilling out the cement, the well was passed for production test.

Well No. 54, production test. T 4-1133.

Shut-off approved.

Well No. 55, drill. P 4-704.

Proposal approved.

Well No. 55, shut-off. T 4-1013.

Passed for production test.

Well No. 55, production. T 4-1132.

Shut-off approved.

Well No. 56, drill. P 4-705.

Proposal approved.

Well No. 56, shut-off. T 4-976.

Passed for production test.

## Midway Gas Co.

Well No. 60, shut-off. T 4-545.

Shut-off approved.

Well No. 61, drill. P 4-580.

Proposal approved.

Well No. 61, shut-off. T 4-701.

Shut-off approved.

## SECTION 10.

## Honolulu Consolidated Oil Co.

Well No. 12, drill. P 4-592.

Proposal approved.

Well No. 12, shut-off. T 4-632.

Passed for production test.

Well No. 12, abandon. P 4-945.

Proposal approved.

Well No. 13, drill. P 4-1000.

Proposal rejected.

Well No. 13, drill. P 4-1053.

Proposal approved.

Well No. 13, shut-off. T 4-1030.

Shut-off approved.

## Honoulu Consolidated Oil Co.—Continued.

- Well No. 13, deepen. P 4-1338.  
Proposal answered with recommendations.
- Well No. 14, drill. P 4-1104.  
Proposal approved.
- Well No. 14, shut-off. T 4-1118.  
Shut-off approved.
- Well No. 15, shut-off. T 4-1315.  
Shut-off approved.
- Well No. 15, drill. P 4-1292.  
Proposal approved.
- Well No. 16, drill. P 4-1372.  
Proposal answered with recommendations.

## SECTION 15.

## Southern Pacific Company, Fuel Oil Department.

- Well No. 5, redrill. P 4-1463.  
Proposal approved.
- Well No. 8, drill. P 4-1240.  
Proposal approved.
- Well No. 8, shut-off. T 4-1317.  
Shut-off approved.
- Well No. 9, drill. P 4-1239.  
Proposal approved.
- Well No. 41, drill. P 4-851.  
Proposal approved.
- Well No. 41, shut-off. T 4-873.  
Shut-off approved.
- Well No. 43, drill. P 4-853.  
Proposal approved.
- Well No. 43, shut-off. T 4-1286.  
Shut-off approved.
- Well No. 43, supplementary drill. P 4-1358.  
Proposal approved.
- Well No. 44, drill. P 4-852.  
Proposal approved.
- Well No. 45, drill. P 4-850.  
Proposal approved.

## Midway Gas Co.

- Well No. 69, drill. P 4-1414.  
Proposal approved.

## SECTION 16.

## Standard Oil Co. "Derby."

- Well No. 11, redrill. P 4-644.  
Proposal approved.
- Well No. 11, shut-off. T 4-775.  
Shut-off approved.
- Well No. 14, supplementary redrill. P 4-1323.  
Proposal approved.
- Well No. 17, redrill. P 4-1325.  
Proposal approved conditionally.
- Well No. 18, redrill. P 4-1399.  
Proposal approved.
- Well No. 18, shut-off. T 4-1374.  
Shut-off unsatisfactory.
- Well No. 21, redrill. DD-908.  
Proposal approved.

## Standard Oil Co., "Derby"—Continued.

Well No. 21, shut-off. T 4-731.

Decision withheld.

Well No. 21, shut-off. T 4-1183.

Shut-off approved.

Well No. 24, shut-off. T 4-671.

Shut-off approved.

Well No. 25, shut-off. T 4-515.

Shut-off unsatisfactory.

Well No. 25, shut-off. T 4-619.

Passed for production test.

Well No. 26, shut-off. T 4-551.

Shut-off approved.

Well No. 27, drill. P 4-651.

Proposal approved.

Well No. 27, shut-off. T 4-856.

Shut-off approved.

Well No. 28, drill. P 4-730.

Proposal approved.

Well No. 28, shut-off. T 4-872.

Passed for production test.

Well No. 29, drill. P 4-740.

Proposal approved in part.

Well No. 29, shut-off. T 4-897.

Shut-off approved.

Well No. 30, drill. P 4-1476.

Proposal approved.

Well No. 31, drill. P 4-808.

Proposal approved conditionally.

Well No. 31, shut-off. T 4-1018.

Shut-off approved.

## St. Helens Petroleum Co., Ltd.

Well No. 17, shut-off. T 4-578.

Shut-off approved.

Well No. 19, shut-off. T 4-528.

Passed for production test.

Well No. 19, production test. T 4-667.

Shut-off approved.

Well No. 21, shut-off. T 4-584.

Shut-off approved.

Well No. 22, drill. P 4-610.

Proposal approved.

Well No. 22, shut-off. T 4-637.

Shut-off approved.

Well No. 23, drill. P 4-736.

Proposal approved.

Well No. 23, shut-off. T 4-779.

Shut-off approved.

Well No. 23, deepen. P 4-1101.

Consideration withheld pending receipt of log.

Well No. 23, redrill. P 4-1128.

Proposal rejected.

Well No. 24, drill. P 4-875.

Proposal approved.

Well No. 24, special test. T 4-970.

Test inconclusive.

Well No. 24, special test. T 4-971.

Passed for production test.

## St. Helens Petroleum Co., Ltd.—Continued.

Well No. 25, drill. P 4-1096.

Proposal approved.

Well No. 25, shut-off. T 4-1130.

Shut-off approved.

## Southern California Gas Co.

Well No. 1, redrill. P 4-1072.

Proposal approved.

Well No. 6, shut-off. T 4-1203.

Test inconclusive.

Well No. 6, shut-off. T 4-1274.

Shut-off approved.

Well No. 7, drill. P 4-582.

Proposal approved.

Well No. 7, shut-off. T 4-680.

Shut-off approved.

## Petroleum Midway Company, Ltd.

Well No. 4, shut-off. T 4-585.

Decision withheld.

Well No. 9a, shut-off. T 4-607.

Shut-off approved.

Well No. 11, drill. P 4-712.

Proposal approved.

Well No. 11, shut-off. T 4-845.

Test unsatisfactory.

Well No. 11, shut-off. T 4-857.

Shut-off not approved, but permission given to complete well conditionally.

Well No. 12, drill. P 4-1477.

Proposal answered with recommendations.

Well No. 14, drill. P 4-1021.

Proposal approved.

Well No. 14, shut-off. T 4-1067.

Test inconclusive.

Well No. 14, shut-off. T 4-1068.

Test inconclusive.

Well No. 14, shut-off. T 4-1080.

Shut-off approved.

Well No. 14, redrill. P 4-1247.

Proposal approved.

Well No. 15, drill. P 4-1148.

Proposal approved conditionally.

## SECTION 17.

## Southern Pacific Company, Fuel Oil Department.

Well No. 10, shut-off. T 4-612.

Shut-off approved.

Well No. 10, deepen. P 4-673.

Proposal approved.

Well No. 10, shut-off. T 4-688.

Shut-off approved conditionally.

Well No. 25, shut-off. T 4-630.

Shut-off approved.

Well No. 25, plug. P 4-871.

Consideration withheld pending receipt of signed copies of log.

Well No. 29, shut-off. T 4-620.

Shut-off approved.

Well No. 60, drill. P 4-884.

Proposal approved.

## Southern Pacific Co., Fuel Oil Department—Continued.

- Well No. 60, shut-off. T 4-977.  
Shut-off approved.  
Well No. 60, shut-off. T 4-1023.  
Passed for production test.  
Well No. 60, redrill. P 4-1421.  
Decision withheld pending receipt of records.  
Well No. 61, drill. P 4-885.  
Proposal approved.  
Well No. 61, supplementary drill. P 4-1461.  
Proposal approved.  
Well No. 63, drill. P 4-886.  
Proposal approved.  
Well No. 63, shut-off. P 4-952.  
Test inconclusive.  
Well No. 63, shut-off. T 4-933.  
Test inconclusive.  
Well No. 63, shut-off. T 4-938.  
Passed for production test.  
Well No. 63, redrill. P 4-1205.  
Consideration withheld pending receipt of log.  
Well No. 64, drill. P 4-887.  
Proposal approved.  
Well No. 64, shut-off. T 4-1217.  
Shut-off approved.  
Well No. 65, drill. P 4-888.  
Proposal approved.  
Well No. 65, shut-off. T 4-903.  
Shut-off approved.

## SECTION 1S.

## Standard Oil Company.

- Well No. 7, redrill. P 4-597.  
Proposal approved.  
Well No. 10, redrill. P 4-1124.  
Proposal to plug approved.  
Well No. 13, redrill. P 4-1121.  
Proposal approved.  
Well No. 14, shut-off. T 4-698.  
Decision withheld pending result of pumping test.  
Well No. 16, supplementary redrill. P 4-913.  
Decision withheld pending receipt of records.  
Well No. 16, supplementary redrill. P 4-944.  
Proposal approved.  
Well No. 16, abandon. P 4-1317.  
Proposal approved.  
Well No. 17, shut-off. D-930.  
Shut-off approved.  
Well No. 17, shut-off. T 4-504.  
Shut-off approved.  
Well No. 19, fluid level test. T 4-595.  
Decision withheld pending result of pumping test.  
Well No. 20, shut-off. T 4-674.  
Passed for pumping test.  
Well No. 20, supplementary drill. P 4-781.  
Proposal approved conditionally.  
Well No. 20, shut-off. T 4-780.  
Shut-off approved.  
Well No. 20, shut-off. T 4-805.  
Shut-off approved.

Standard Oil Co.—Continued.

Well No. 20, supplementary drill. P 4-903.

Proposal answered with recommendations.

#### SECTION 19.

Southern Pacific Company, Fuel Oil Department.

Well No. 3, drill. P 4-635.

Proposal approved.

Well No. 4, drill. P 4-634.

Proposal approved.

Well No. 4, supplementary drill. P 4-764.

Proposal approved.

Well No. 4, shut-off. T 4-812.

Shut-off rejected.

Well No. 4, supplementary drill. P 4-881.

Proposal approved conditionally.

Well No. 4, abandon. P 4-1202.

Approval withheld pending receipt of signed copies of log.

Well No. 5, drill. P 4-633.

Proposal approved.

Well No. 6, drill. P 4-632.

Proposal approved.

Well No. 6, shut-off. T 4-1159.

Shut-off approved.

Well No. 23, drill. P 4-1235.

Proposal approved.

Well No. 23, shut-off. T 4-1251.

Shut-off approved.

Well No. 23, deepen. P 4-1290.

Proposal approved.

Well No. 23, shut-off. T 4-1262.

Shut-off approved.

Well No. 33, shut-off. T 4-596.

Shut-off approved.

Well No. 37, shut-off. T 4-561.

Test unsatisfactory.

Well No. 37, shut-off. T 4-576.

Shut-off rejected.

Well No. 37, supplementary drill. P 4-626.

Proposal approved.

Well No. 37, shut-off. T 4-609.

Shut-off approved.

#### SECTION 20.

Standard Oil Co.

Well No. 1, redrill. P 4-762.

Proposal answered with recommendations.

Well No. 1, shut-off. T 4-915.

Passed for production test.

Well No. 1, redrill. P 4-1236.

Proposal approved.

Well No. 1, shut-off. T 4-1361.

Test inconclusive.

Well No. 1, shut-off. T 4-1362.

Test inconclusive.

Well No. 1, shut-off. T 4-1373.

Test inconclusive.

Well No. 3, redrill. P 4-1371.

Proposal answered with specifications.

## SECTION 21.

Southern Pacific Company, Fuel Oil Department.

Well No. 33, drill. P 4-1188.

Proposal approved.

Well No. 33, supplementary drill. P 4-1397.

Proposal approved.

Well No. 34, drill. P 4-1086.

Proposal approved.

Well No. 34, shut-off. T 4-1151.

Test inconclusive.

Well No. 34, shut-off. T 4-1152.

Passed for production test.

Well No. 34, plug. P 4-1360.

Proposal approved.

Well No. 36, drill. P 4-1087.

Proposal approved.

Well No. 36, shut-off. T 4-1174.

Shut-off approved.

Well No. 37, drill. P 4-1190.

Proposal approved.

Well No. 37, supplementary drill. P 4-1456.

Proposal approved.

## SECTION 22.

Maricopa Investment Company.

Well No. 1, abandon. P 4-982.

Proposal approved conditionally.

Well No. 1, alter casing. P 4-1150.

Proposal approved conditionally.

## SECTION 23.

Standard Oil Co.

Well No. 9, shut-off. T 4-669.

Shut-off approved.

Well No. 10, drill. P 4-1230.

Proposal approved.

Well No. 11, drill. P 4-1480.

Proposal approved.

## SECTION 29.

Southern Pacific Company, Fuel Oil Department.

Well No. 2, supplementary drill. P 4-1503.

Proposal approved.

## SECTION 30.

Standard Oil Co.

Well No. 7, redrill. P 4-1305.

Proposal approved conditionally.

Well No. 14, redrill. P 4-768.

Proposal approved conditionally.

Well No. 14, shut-off. T 4-864.

Shut-off approved.

Well No. 29, drill. P 4-571.

Proposal approved conditionally.

Well No. 29, shut-off. T 4-709.

Passed for production test.

Well No. 29, production test. T 4-1043.

Shut-off approved.

Well No. 30, shut-off. T 4-645.

Shut-off approved.

Well No. 31, drill. P 4-1331.

Proposal approved.

## Standard Oil Co.—Continued.

Well No. 32, drill. P 4-896.

Proposal rejected.

Well No. 32, shut-off. T 4-935.

Test inconclusive.

Well No. 32, shut-off. T 4-942.

Test unsatisfactory.

Well No. 32, supplementary drill. P 4-1013.

Proposal approved.

Well No. 32, special test. T 4-963.

Test showed proposed method of cementing impracticable.

Well No. 32, supplementary drill. P 4-1037.

Proposal approved.

Well No. 32, shut-off. T 4-1046.

Shut-off approved.

Well No. 33, drill. P 4-1262.

Proposal approved.

Well No. 33, supplementary drill. P 4-1304.

Proposal approved conditionally.

Well No. 33, shut-off. T 4-1288.

Shut-off approved conditionally.

Well No. 34, drill. P 4-637.

Proposal approved conditionally.

Well No. 34, shut-off. T 4-736.

Shut-off approved.

Well No. 35, drill. P 4-1020.

Proposal approved.

Well No. 35, shut-off. P 4-1060.

Passed for production test.

Well No. 36, drill. P 4-1334.

Proposal answered with recommendations.

## SECTION 31.

## Standard Oil Co.

Well No. 2, drill. P 4-676.

Proposal approved.

Well No. 2, shut-off. T 4-745.

Shut-off rejected.

Well No. 2, shut-off. T 4-835.

Shut-off approved.

Well No. 2, deepen and redrill. P 4-1255.

Proposal approved conditionally.

Well No. 2, shut-off. P 4-1261.

Test inconclusive.

Well No. 3, drill. P 4-1209.

Proposal approved conditionally.

Well No. 3, supplementary drill. P 4-1271.

Proposal approved conditionally.

Well No. 3, shut-off. T 4-1229.

Passed for production test.

Well No. 4, drill. P 4-1289.

Proposal answered with recommendations.

## SECTION 32.

## Knickerbocker Oil Co.

Well No. 1, abandon. P 4-767.

Proposal answered with recommendations.

Well No. 1, supplementary abandon. P 4-1135.

Proposal approved.

## Hurley, Stone &amp; Co.

Well No. 1, deepen. P 4-1324.

Proposal approved conditionally.

Well No. 2, redrill. P 4-1204.

Decision withheld pending receipt of records.

Well No. 2, redrill. P 4-1223.

Proposal answered with recommendations.

Well No. 2, shut-off. P 4-1156.

Passed for production test.

## General Petroleum Corporations.

Well No. 14, shut-off. T 4-1212.

Production test showed shut-off unsatisfactory.

Well No. 14, redrill. P 4-1362.

Proposal approved.

## American Oilfields Co.

Well No. 1, redrill. P 4-879.

Proposal approved conditionally.

Well No. 4, redrill. P 4-1063.

Proposal approved with recommendations.

Well No. 4, special test. T 4-1041.

Fluid level determined.

Well No. 4, shut-off. T 4-1094.

Test unsatisfactory.

Well No. 4, shut-off. T 4-1149.

Passed for production test.

Well No. 4, shut-off. T 4-1150.

Shut-off rejected.

Well No. 7, redrill. P 4-1064.

Proposal approved with recommendations.

Well No. 8, redrill. P 4-1377.

Proposal answered with recommendations.

Well No. 12, shut-off. T 4-616.

Shut-off approved.

Well No. 13, redrill. P 4-1221.

Proposal answered with recommendations.

## SECTION 33.

## Southern Pacific Company, Fuel Oil Department.

Well No. 14, drill. P 4-1196.

Proposal rejected.

Well No. 14, drill, supplementary. P 4-1232.

Proposal answered with recommendations.

Well No. 14, shut-off. T 4-1333.

Decision withheld.

Well No. 15, drill. P 4-1197.

Proposal rejected.

Well No. 16, shut-off. T 4-591.

Shut-off approved.

Well No. 16, supplementary drill. P 4-627.

Proposal approved.

Well No. 21, shut-off. T 4-536.

Shut-off approved.

## SECTION 34.

## Lakeview No. 2 Oil Co.

Well No. 1, redrill. P 4-1213.

Proposal approved conditionally.

## Lakeview No. 2 Oil Co.—Continued.

Well No. 23, shut-off. T 4-729.

Re-cementing recommended.

Well No. 23, shut-off. T 4-810.

Shut-off approved.

Well No. 23, redrill. P 4-1225.

Proposal approved conditionally.

Well No. 23, shut-off. T 4-1111.

Shut-off approved conditionally.

Well No. 25, drill. P 4-727.

Proposal rejected pending result of work on adjoining well No. 1.

## SUNSET FIELD.

T. 11 N., R. 23 W., S.B.M. &amp; M.

## SECTION 4.

## Interstate Oil Co.

Well No. 8, redrill. P 4-500.

Proposal approved.

Well No. 8, shut-off. T 4-569.

Test inconclusive.

Well No. 8, redrill. P 4-655.

Proposal approved.

Well No. 8, special test. T 4-813.

Cementing approved.

Well No. 8, shut-off. T 4-874.

Shut-off approved.

Well No. 10, shut-off. D-922.

Shut-off approved.

Well No. 10, shut-off. T 4-568.

Passed for production test.

Well No. 14, shut-off. T 4-553.

Shut-off approved.

Well No. 16, drill. P 4-608.

Proposal approved conditionally.

Well No. 16, shut-off. T 4-676.

Test inconclusive.

Well No. 16, special test. T 4-752.

Cementing approved.

Well No. 16, shut-off. T 4-797.

Shut-off approved.

Well No. 18, drill. P 4-677.

Proposal approved.

Well No. 18, shut-off. T 4-815.

Shut-off unsatisfactory.

Well No. 18, supplementary drill. P 4-863.

Proposal approved.

Well No. 18, special test. T 4-842.

Cementing approved.

Well No. 18, supplementary drill. P 4-1277.

Proposal rejected with recommendations.

Well No. 18, supplementary drill. P 4-1287.

Proposal rejected.

Well No. 18, shut-off. T 4-1252.

Test inconclusive.

Well No. 20, drill. P 4-672.

Proposal approved.

Well No. 20, shut-off. T 4-980.

Test inconclusive.

## Interstate Oil Co.—Continued.

Well No. 20, supplementary drill. P 4-1111.

Proposal approved conditionally.

Well No. 20, shut-off. T 4-1173.

Shut-off rejected.

Well No. 22, drill. P 4-1031.

Proposal approved.

Well No. 22, shut-off. T 4-1055.

Shut-off unsatisfactory.

Well No. 22, supplementary drill. P 4-1234.

Proposal approved.

Well No. 22, shut-off. T 4-1265.

Passed for production test.

## Lakeview No. 2 Oil Co.

Well No. 1, special test. T 4-693.

Cementing approved.

Well No. 1, shut-off. T 4-675.

Shut-off approved.

Well No. 1, production test. T 4-699.

Test satisfactory.

This well is the Lakeview No. 2 gusher which came in out of control on May 10, 1914, and flowed continuously for 167 days, producing during that period approximately 3,500,000 barrels of oil.

Following the cessation of the well's flow, the company was occupied for about two years in an attempt to put the well in a producing condition. The violent flow of the well wrecked the rig and blew out a crater over the hole of such extent that 46 days time was spent in putting the surface in the condition necessary for the erection of a new rig.

After this rig was up and the first attempts to work on the well were made, the well again came in, wrecking the rig and generally creating havoc. It flowed wild for nine days.

After rigging up again over the hole, the company was able to complete the repairs on the well only after many months work. A great deal of the success of the work has been attributed to the correct use of mud-laden fluid.

That the redrilling was successful is proven by the above test, for after completion the well flowed practically clean oil.

Well No. 7, deepen. P 4-1207.

Proposal approved.

Well No. 9, special test. T 4-500.

Cementing approved.

Well No. 9, shut-off. T 4-575.

Shut-off approved.

Well No. 11, production test. T 4-516.

Another test recommended.

Well No. 11, shut-off. T 4-552.

Shut-off approved.

Well No. 13, drill. P 4-807.

Proposal approved.

Well No. 13, supplementary drill. P 4-890.

Proposal approved.

Well No. 13, shut-off. T 4-918.

Passed for production test.

Well No. 13, production test. T 4-1321.

Shut-off approved.

Well No. 15, drill. P 4-1094.

Proposal approved.

Well No. 15, shut-off. T 4-1166.

Passed for production test.

## Lakeview No. 2 Oil Co.—Continued.

Well No. 15, redrill. P 4-1352.

Proposal approved.

Well No. 17, drill. P 4-1312.

Proposal approved.

Well No. 17, shut-off. T 4-1316.

Shut-off approved.

## Union Oil Co., "International."

Well No. 6, drill. P 4-584.

Proposal rejected with recommendations.

Well No. 6, special test. T 4-689.

Witnessed mudding.

Well No. 6, special test. T 4-702.

Mudding approved.

Well No. 6, special test. T 4-723.

Mudding of oil sand approved.

Well No. 6, special test. T 4-766.

Cementing not approved.

Well No. 6, shut-off. T 4-802.

Shut-off approved.

Well No. 7, drill. P 4-694.

Proposal answered with specifications.

Well No. 7, deepen. P 4-987.

Proposal answered with recommendations.

Well No. 7, supplementary drill. P 4-1259.

This proposal was received one day before that set for a hearing before the Board of District Oil and Gas Commissioners and the State Oil and Gas Supervisor to finally determine the proper method of procedure in drilling this well. It was refused consideration.

## Pat Welch Co.

Well No. 2, drill. P 4-647.

Proposal answered with recommendations.

Well No. 2, special test. T 4-793.

Cementing approved.

Well No. 2, shut-off. T 4-825.

Shut-off unsatisfactory.

Well No. 2, deepen. P 4-889.

Proposal approved.

Well No. 2, shut-off. T 4-851.

Shut-off approved for prospecting ahead.

Well No. 2, special test. T 4-962.

Witnessed well flowing.

Well No. 2, alter casing. P 4-1286.

Proposal answered with recommendations.

Well No. 2, shut-off. T 4-1231.

Recommended that the company submit a proposal outlining method of correcting existing conditions.

Well No. 3, redrill. P 4-653.

Proposal answered with recommendations.

Well No. 3, deepen. P 4-1106.

Proposal approved conditionally.

Well No. 4, shut-off. T 4-514.

Shut-off approved.

Well No. 4, redrill. P 4-714.

Proposal approved.

Well No. 5, drill. P 4-1256.

Proposal approved.

## SECTION 5.

Southern Pacific Company, Fuel Oil Department.

Well No. 26, drill. P 4-1321.

Proposal approved.

Well No. 27, drill. P 4-1151.

Proposal answered with recommendations.

Well No. 28, drill. P 4-761.

Proposal approved conditionally.

Well No. 28, shut-off. T 4-987.

Shut-off approved.

Well No. 29, shut-off. T 4-598.

Shut-off unsatisfactory.

Well No. 29, special test. T 4-744.

Cementing witnessed.

Well No. 29, shut-off. T 4-787.

Shut-off approved.

Well No. 29, special test. T 4-853.

Cementing approved.

Well No. 29, supplementary drill. P 4-900.

Proposal approved conditionally.

Well No. 29, shut-off. T 4-936.

Shut-off approved.

Well No. 30, drill. P 4-523.

Proposal answered with recommendations as to shut-off.

Well No. 30, supplementary drill. P 4-1047.

Proposal approved.

Well No. 30, supplementary drill. P 4-1077.

Proposal approved.

Well No. 30, shut-off. T 4-1033.

Shut-off approved.

Well No. 31, special test. T 4-501.

Cementing approved.

Well No. 31, shut-off. T 4-538.

Shut-off approved.

Well No. 61, drill. P 4-524.

Proposal answered with recommendations as to shut-off.

Well No. 62, drill. P 4-525.

Proposal approved.

Well No. 62, supplementary drill. P 4-800.

Proposal approved.

Well No. 63, drill. P 4-526.

Proposal answered with recommendations as to shut-off.

Well No. 63, supplementary drill. P 4-1091.

Proposal approved.

Well No. 63, supplementary drill. P 4-1077.

Proposal approved.

Well No. 64, drill. P 4-527.

Proposal answered with recommendations as to shut-off.

Well No. 64, shut-off. T 4-597.

Decision withheld pending result of pumping test.

Well No. 64, production test. T 4-773.

Shut-off approved.

Well No. 65, drill. P 4-528.

Proposal approved.

Well No. 65, shut-off. T 4-1175.

Test inconclusive.

Well No. 65, redrill. P 4-1339.

Proposal approved.

## Southern Pacific Co., Fuel Oil Department. Continued.

- Well No. 65, shut-off. T 4-1300.  
 Shut-off unsatisfactory.  
 Well No. 65, supplementary drill. P 4-1455.  
 Proposal approved conditionally.  
 Well No. 138, drill. P 4-529.  
 Proposal approved.  
 Well No. 138, supplementary drill. P 4-898.  
 Proposal approved.  
 Well No. 138, special test. T 4-869.  
 Cementing approved.  
 Well No. 138, shut-off. T 4-891.  
 Shut-off approved.  
 Well No. 138, supplementary drill. P 4-1236.  
 Proposal approved.  
 Well No. 138, supplementary drill. P 4-1231.  
 Proposal approved with recommendations.  
 Well No. 138, shut-off. T 4-1172.  
 Another test recommended.  
 Well No. 138, shut-off. T 4-1184.  
 Shut-off rejected.  
 Well No. 138, supplementary drill. P 4-1279.  
 Proposal approved recommendations.

## SECTION 6.

## Bankline Oil Co.

- Well No. 1, abandon. P 4-679.  
 Proposal answered with specifications.  
 Well No. 1, supplementary abandon. P 4-864.  
 Proposal approved.  
 Well No. 5, abandon. P 4-606.  
 Proposal approved.

## General Petroleum Corporation.

- Well No. 6-B, abandon. P 4-618.  
 Proposal answered with recommendations.  
 Well No. 6-B, abandon. P 4-622.  
 Proposal approved.  
 Well No. 7-B, abandon. P 4-656.  
 Proposal approved.  
 Well No. 9-B, plug. P 4-1126.  
 Proposal approved.  
 Well No. 9-B, redrill. P 4-1220.  
 Proposal approved conditionally.  
 Well No. 9-B, shut-off. T 4-1193.  
 Shut-off rejected.  
 Well No. 9-B, supplementary redrill. P 4-1350.  
 Proposal approved.  
 Well No. 9-B, shut-off. T 4-1359.  
 Mudding and cementing witnessed.  
 Well No. 9-B, supplementary redrill. P 4-1485.  
 Proposal approved.  
 Well No. 11-B, abandon. P 4-995.  
 Proposal answered with recommendations.  
 Well No. 11-B, Abandon. P 4-1263.  
 Proposal approved.  
 Well No. 12-B, supplementary drill. P 4-1051.  
 Proposal approved.  
 Well No. 12-B, shut-off. T 4-1051.  
 Test to determine what future work is necessary.

H. H. Hart and H. M. Payne.

Well No. 1, shut-off. T 4-695.

Shut-off approved.

Well No. 1, redrill. P 4-753.

Proposal approved.

Well No. 1, shut-off. T 4-1071.

Shut-off rejected.

Maricopa National Petroleum Co.

Well No. 5, redrill. P 4-520.

Proposal approved with recommendations.

Well No. 7, redrill. P 4-519.

Proposal approved.

Well No. 7, abandon. P 4-1024.

Proposal approved with recommendations.

Well No. 7, special test. T 4-1074.

Mudding approved.

Well No. 7, special test. T 4-1075.

Placing of cement plug approved.

Well No. 7, shut-off. T 4-1076.

Shut-off rejected.

Well No. 7, shut-off. T 4-1182.

Test satisfactory.

#### SECTION 7.

Standard Oil Co., "Monarch."

Well No. 1, redrill. P 4-791.

Proposal approved.

Well No. 2, shut-off. T 4-681.

Passed for production test.

Well No. 2, production test. T 4-1044.

Shut-off approved.

Well No. 4, drill. P 4-760.

Proposal approved conditionally.

Well No. 4, supplementary drill. P 4-902.

Proposal approved.

Well No. 4, supplementary drill. P 4-908.

Proposal approved conditionally.

Well No. 4, shut-off. T 4-875.

Shut-off approved.

Well No. 5, drill. P 4-759.

Proposal approved conditionally.

Well No. 5, shut-off. T 4-858.

Shut-off unsatisfactory.

Well No. 5, supplementary drill. P 4-972.

Proposal approved conditionally.

Well No. 5, shut-off. T 4-931.

Shut-off approved.

Well No. 6, drill. P 4-940.

Proposal approved conditionally.

Well No. 6, shut-off. T 4-909.

Passed for production test.

Well No. 6, production test. T 4-1208.

Decision deferred.

Well No. 7, drill. P 4-1327.

Proposal approved.

Well No. 7, shut-off. T 4-1351.

Shut-off approved.

Well No. 8, drill. P 4-1328.

Proposal answered with recommendations as to shut-off.

## Standard Oil Co., "Monarch"—Continued.

Well No. 9, drill. P 4-1329.

Proposal approved conditionally.

## Yellowstone Oil Co.

Well No. 1, abandon. P 4-648.

Proposal answered with specifications.

Well No. 1, supplementary abandon. P 4-832.

Proposal answered with further specifications.

Well No. 1, supplementary abandon. P 4-848.

Proposal answered with modifications of Report No. P 4-832.

Well No. 1, supplementary abandon. P 4-978.

Proposal answered with further modifications of the original recommendations.

## T. 11 N., R. 24 W., S.B.B. &amp; M.

## SECTION 1.

## Lowell Oil Co.

Well No. 10, redrill. P 4-1315.

Proposal approved.

## Standard Oil Co., "Maricopa."

Well No. 11, redrill. P 4-1125.

Proposal approved conditionally.

Well No. 23, redrill. P 4-603.

Proposal answered with recommendations.

Well No. 23, redrill. P 4-825.

Proposal approved conditionally.

Well No. 23, shut-off. T 4-807.

Another test recommended.

Well No. 23, shut-off. T 4-818.

Passed for production test.

Well No. 23, production test. T 4-1209.

Shut-off rejected.

Well No. 26, redrill. P 4-535.

Proposal approved conditionally.

Well No. 26, shut-off. T 4-565.

Passed for production test.

Well No. 26, production test. T 4-1039.

Test showed well making small amount of water.

## SECTION 2.

## Anchor Oil Co.

Well No. 1, redrill. P 4-857.

Proposal answered with recommendations.

Well No. 1, shut-off. T 4-1107.

Shut-off approved.

Well No. 1, redrill. P 4-1348.

Proposal approved.

Well No. 2, deepen. P 4-734.

Proposal approved.

Well No. 12, redrill. P 4-683.

Proposal approved conditionally.

## Ida May Oil Co.

Well No. 5 (new), shut-off. T 4-573.

Shut-off approved.

## Maricopa National Petroleum Co.

Well No. 1, redrill. P 4-640.

Proposal approved.

Well No. 2, redrill. P 4-862.

Proposal answered with recommendations.

## Maricopa National Petroleum Co.—Continued.

Well No. 2, shut-off. T 4-966.

Shut-off approved.

## McCutchen Bros.

Well No. 3, redrill. P 4-1081.

Proposal answered with recommendations.

## Standard Oil Co., "Monarch."

Well No. 3, redrill. P 4-932.

Proposal satisfactory.

Well No. 3, shut-off. T 4-905.

Shut-off approved.

Well No. 28, redrill. DD-910.

Proposal approved.

Well No. 33, redrill. P 4-1110.

Decision withheld pending the receipt of log.

Well No. 33, redrill. P 4-1162.

Proposal approved.

Well No. 33, shut-off. T 4-1189.

Shut-off approved.

Well No. 37, shut-off. T 4-512.

Shut-off approved.

Well No. 38, shut-off. T 4-541.

Passed for production test.

Well No. 39, drill. P 4-1475.

Proposal approved.

Well No. 40, drill. P 4-931.

Proposal answered with recommendations.

Well No. 40, shut-off. T 4-951.

Shut-off approved.

Well No. 40, redrill. P 4-1294.

Proposal approved.

Well No. 40, shut-off. T 4-1256.

Shut-off approved.

Well No. 40, shut-off. T 4-1282.

Shut-off approved.

## United Oil Co.

Well No. 4, redrill. P 4-901.

Proposal answered with recommendations.

Well No. 7, drill. P 4-1341.

Proposal answered with recommendations as to shut-off.

Well No. 7, drill. P 4-1404.

This report to supersede and nullify report No. P 4-1341. Answered with recommendations as to point of shut-off.

Well No. 7, special test. T 4-1347.

Test to locate source of water.

## SECTION 3.

## Heard &amp; Painter Co., "Geneseo."

Well No. 7, drill. P 4-605.

Proposal approved conditionally.

Well No. 7, shut-off. T 4-581.

Shut-off approved.

Well No. 8, drill. P 4-1425.

Proposal approved.

## SECTION 12.

## Good Roads Oil Co.

Well No. 7-A, redrill. DD-905.

Proposal approved.

## Good Roads Oil Co.--Continued.

Well No. 7-A, shut-off. T 4-502.

Shut-off approved.

Well No. 7-A, shut-off. T 4-663.

Test indicated that bottom water had broken around plug in bottom of hole.

Well No. 7-A, shut-off. T 4-756.

Bottom water shut-off approved.

Well No. 7-A, abandon. P 4-928.

Proposal approved.

Well No. 11, drill. P 4-1266.

Proposal approved.

Well No. 11, special test. T 4-1279.

Recommended the hole be bailed and left standing for 12 hours for the next test.

Well No. 11, shut-off. T 4-1280.

Shut-off approved.

## Water Snook Oil Co.

Well No. 5, drill. P 4-1075.

Proposal approved conditionally.

T. 12 N., R. 23 W., S.B.B. & M.

## SECTION 30.

## Whittaker, Doan and Laymance Oil Co.

Well No. 1, shut-off. T 4-539.

Shut-off unsatisfactory.

## SECTION 31.

## Southern Pacific Company, Fuel Oil Department.

Well No. 2, deepen. P 4-619.

Proposal approved.

Well No. 2, special test. T 4-791.

Cementing approved.

Well No. 2, abandon. P 4-1018.

Proposal approved conditionally.

Well No. 2 (new), drill. P 4-1050.

Proposal approved.

Well No. 2 (new), shut-off. T 4-1078.

Shut-off approved.

Well No. 2 (new), plug. P 4-1246.

Proposal approved.

Well No. 3, shut-off. T 4-832.

Shut-off approved.

Well No. 5, shut-off. T 4-757.

Test unsatisfactory.

Well No. 5, shut-off. T 4-765.

Passed for production test.

Well No. 5, production test. T 4-939.

Shut-off approved.

Well No. 6, shut-off. T 4-697.

Decision withheld pending receipt of history of well.

Well No. 6, redrill. P 4-741.

Proposal approved.

Well No. 6, shut-off. T 4-742.

Shut-off approved.

Well No. 41, drill. P 4-1395.

Proposal approved.

Well No. 42, drill. P 4-1394.

Proposal approved.

## Southern Pacific Co., Fuel Oil Department—Continued.

Well No. 43, drill. P 4-1393.

Proposal approved.

Well No. 44, drill. P 4-1392.

Proposal approved.

Well No. 45, drill. P 4-1391.

Proposal approved.

Well No. 46, drill. P 4-1347.

Proposal answered with recommendations as to point of shut-off.

Well No. 46, shut-off. T 4-1349.

Test inconclusive.

Well No. 46, shut-off. T 4-1354.

Test inconclusive.

Well No. 46, shut-off. T 4-1355.

Passed for production test.

Well No. 58, supplementary drill. P 4-949.

Proposal approved.

Well No. 58, shut-off. T 4-884.

Shut-off approved.

Well No. 59, shut-off. T 4-587.

Shut-off approved.

Well No. 60, redrill. P 4-739.

Proposal approved.

Well No. 60, shut-off. T 4-747.

Shut-off approved.

Well No. 60, special test. T 4-854.

Cementing approved.

Well No. 60, shut-off. T 4-860.

Shut-off approved.

Well No. 61, shut-off. T 4-566.

Shut-off approved.

Well No. 61, supplementary drill. P 4-765.

Proposal approved conditionally.

Well No. 61, shut-off. T 4-762.

Approval withheld pending receipt of statement as to cementing.

Well No. 61, shut-off. T 4-767.

Shut-off approved.

Well No. 71, drill. P 4-1390.

Proposal approved.

Well No. 72, drill. P 4-1389.

Proposal approved.

Well No. 73, drill. P 4-1388.

Proposal approved.

Well No. 74, drill. P 4-1387.

Proposal approved.

Well No. 75, drill. P 4-1386.

Proposal approved.

Well No. 76, drill. P 4-1385.

Proposal approved.

Well No. 77, drill. P 4-1384.

Proposal approved.

Well No. 78, drill. P 4-1375.

Proposal answered with recommendations as to point of shut-off.

Well No. 80, drill. P 4-1383.

Proposal approved.

Well No. 81, drill. P 4-1382.

Proposal approved.

## Southern Pacific Co., Fuel Oil Department—Continued.

Well No. 82, drill. P 4-1381.

Proposal approved.

Well No. 83, drill. P 4-1379.

Proposal approved.

Well No. 84, drill. P 4-1380.

Proposal approved.

## SECTION 32.

## General Petroleum Corporation, "Annex."

Well No. 1, redrill. P 4-1356.

Proposal approved with recommendations.

Well No. 2, redrill. P 4-1403.

Proposal answered with recommendations.

Well No. 2, special test. T 4-1324.

Test to determine source of water. Water found to be entering hole from below water string.

Well No. 7-A, drill. P 4-1501.

Proposal approved conditionally.

## Maricopa Star Oil Co.

Well No. 5, shut-off. T 4-543.

Another test recommended.

Well No. 5, shut-off. T 4-544.

Shut-off approved.

Well No. 5, supplementary redrill. P 4-861.

Proposal approved.

Well No. 5, shut-off. T 4-937.

Decision withheld pending receipt of data.

## Midway Northern Oil Co.

Well No. 5, shut-off. T 4-1129.

Answered with recommendations as to correcting conditions.

Well No. 5, deepen. P 4-1335.

Proposal approved.

Well No. 5, shut-off. T 4-1299.

Passed for production test.

## Miocene Oil Co.

Well No. 1, redrill. P 4-1376.

Proposal approved.

Well No. 3, drill. P 4-977.

Proposal approved.

Well No. 3, shut-off. T 4-992.

Passed for production test.

Well No. 3, shut-off. T 4-1140.

Production test; decision withheld pending result of future developments in the neighborhood.

## Spreckles Oil Co.

Well No. 5, shut-off. T 4-940.

Approval withheld pending result of final work on the well.

## Trojan Oil Co.

Well No. 2, drill. P 4-1001.

Proposal approved conditionally.

Well No. 2, shut-off. T 4-1048.

Test inconclusive.

Well No. 2, shut-off. T 4-1049.

Test inconclusive.

Well No. 2, shut-off. T 4-1050.

Another test recommended.

## Trojan Oil Co.—Continued.

Well No. 2, shut-off. T 4-1051.

This test was made preliminary to test of shut-off to determine whether casing leaked. Test of casing satisfactory.

Well No. 2, shut-off. T 4-1059.

Shut-off approved.

## El Dora Oil Co.

Well No. 2, shut-off. T 4-914.

Shut-off approved.

## SECTION 33.

## Southern Pacific Company, Fuel Oil Department.

Well No. 11, drill. P 4-996.

Proposal answered with recommendations as to depth of shut-off.

Well No. 11, shut-off. T 4-1091.

Test inconclusive.

Well No. 11, shut-off. T 4-1102.

Decision deferred pending results of future development.

Well No. 11, redrill. P 4-1337.

Consideration withheld pending receipt of log and history.

Well No. 12, drill. P 4-1109.

Proposal approved.

## SECTION 34.

## Comstock Crude Oil Co.

Well No. 1, abandon. DD-907.

Proposal rejected with recommendations.

T. 12 N., R. 24 W., S.B.B. & M.

## SECTION 25.

## Union Oil Co., "Lakeview."

Well No. 9, redrill. P 4-1166.

Proposal approved.

Well No. 9, supplementary redrill. P 4-1264.

Proposal approved.

Well No. 9, supplementary redrill. P 4-1359.

Proposal approved.

Well No. 14, abandon. P 4-992.

Consideration withheld pending receipt of copies of log and history.

Well No. 14, abandon. P 4-1127.

Proposal answered with recommendations.

## Southern Pacific Company, Fuel Oil Department.

Well No. 4, alter casing. P 4-812.

Proposal approved.

## SECTION 26.

## Standard Oil Co., "Monarch."

Well No. 2, deepen. P 4-636.

Proposal approved.

Well No. 2, supplementary deepen. P 4-662.

Proposal approved.

Well No. 2, shut-off. P 4-712.

Passed for production test.

Well No. 6, redrill. P 4-999.

Proposal answered with recommendations as to depth of shut-off.

Well No. 6, shut-off. T 4-646.

Shut-off approved.

Well No. 6, deepen. P 4-868.

Proposal approved.

Well No. 6, redrill. P 4-976.

Proposal approved.

## Standard Oil Co., "Monarch"—Continued.

Well No. 6, shut-off. T 4-1063.

Further tests recommended.

Well No. 6, shut-off. T 4-1064.

Passed for production test.

Well No. 9, redrill. P 4-538.

Proposal answered with recommendations.

Well No. 9, redrill. P 4-585.

Proposal approved.

Well No. 9, shut-off. T 4-656.

Passed for pumping test.

Well No. 9, supplementary redrill. P 4-867.

Proposal approved conditionally.

Well No. 9, supplementary deepen. P 4-975.

Proposal answered with recommendations.

Well No. 12, redrill. P 4-536.

Proposal approved.

Well No. 12, shut-off. T 4-651.

Shut-off approved.

Well No. 13, drill. P 4-631.

Proposal approved.

Well No. 13, shut-off. T 4-740.

Shut-off approved.

Well No. 13, supplementary drill. P 4-981.

Proposal approved.

Well No. 14, drill. P 4-822.

Proposal approved.

Well No. 14, drill. P 4-833.

New location: proposal rejected with recommendations.

Well No. 14, shut-off. T 4-888.

Passed for production test.

Well No. 14, redrill. P 4-1170.

Proposal approved with recommendations.

Well No. 14, drill. P 4-1208.

Proposal approved conditionally.

Well No. 14, shut-off. T 4-1281.

Production test unsatisfactory.

Well No. 15, drill. P 4-675.

Proposal approved.

Well No. 15, shut-off. T 4-782.

Shut-off rejected.

Well No. 15, shut-off. T 4-953.

Decision withheld.

## SECTION 32.

## Mother Colony Oil Co.

Well No. 1, abandon. P 4-607.

Proposal approved conditionally.

## SECTION 33.

## Tannehill Oil Co.

Well No. 3, drill. P 4-1366.

Proposal approved conditionally.

## SECTION 34.

## Hillside Oil Co.

Well No. 1, drill. P 4-1300.

Proposal approved conditionally.

Well No. 1, abandon. P 4-1490.

Proposal answered with specifications.

## Hillside Oil Co. Continued.

Well No. 1, shut-off. T 4-1377.

Test inconclusive.

Well No. 1, shut-off. T 4-1378.

Shut-off satisfactory.

## Garner-Madison Oil Co.

Well No. 1, drill. P 4-1168.

Proposal approved.

Well No. 2, drill. P 4-1413.

Proposal approved.

Well No. 2, shut-off. T 4-1376.

Passed for production test.

## Tannehill Oil Co.

Well No. 9, shut-off. T 4-683.

Production test showed that the well made no water.

Well No. 13, drill. P 4-708.

Proposal approved.

Well No. 14, drill. P 4-910.

Proposal approved.

Well No. 15, drill. P 4-1076.

Proposal approved.

Well No. 15, redrill. P 4-1268.

Proposal answered with recommendations.

## SECTION 35.

## Midway Oil Co.

Well No. 4, abandon. P 4-560.

Proposal answered with specifications.

Well No. 4, supplementary abandon. P 4-1092.

Proposal answered with recommendations.

Well No. 4, special test. T 4-1008.

Shooting approved.

Well No. 4, special test. T 4-1009.

Placing of cement plug approved.

Well No. 4, special test. T 4-1010.

Placing of shot approved.

Well No. 4, special test. T 4-1082.

Plugging not approved. Another attempt recommended.

Well No. 4, special test. T 4-1366.

Placing of cement plug approved.

Well No. 5, abandon. P 4-521.

Proposal answered with specifications.

Well No. 5, revised abandon. P 4-773.

Proposal as revised approved.

Well No. 7, abandon. P 4-542.

Proposal answered with specifications.

Well No. 7, supplementary abandon. P 4-770.

Proposal answered with recommended changes.

Well No. 7, special test. T 4-866.

Placing of plug approved.

Well No. 7, special test. T 4-885.

This report to correct reported depth as shown in report No. T 4-866. Placing of plug approved.

Well No. 7, special test. T 4-893.

Placing of cement plug approved.

Well No. 7, special test. T 4-894.

Shooting approved.

## Midway Oil Co.—Continued.

Well No. 7, special test. T 4-923.

Placing of cement plug approved.

Well No. 7, special test. T 4-959.

Shooting approved.

Well No. 7, special test. T 4-960.

Placing of cement plug approved.

Well No. 7, special test. T 4-961.

Placing of shot approved.

Well No. 7, special test. T 4-981.

Placing of cement plug approved.

Well No. 7, special test. T 4-982.

Shot approved.

Well No. 7, special test. T 4-983.

Placing of cement plug approved.

Well No. 7, special test. T 4-993.

Placing of plug approved.

Well No. 7, special test. T 4-998.

This report to supersede and nullify report No. T 4-993. Placing of plug approved.

Well No. 7, special test. T 4-1026.

Placing of plug approved.

Well No. 7, special test. T 4-1027.

Placing of shot approved.

Well No. 7, special test. T 4-1028.

Placing of cement plug approved.

Well No. 7, special test. T 4-1047.

Placing of cement plug approved.

Well No. 8, abandon. P 4-543.

Proposal answered with specifications for abandonment.

Well No. 8, supplementary abandon. P 4-720.

Proposal answered with recommendations.

Well No. 8, special test. T 4-716.

Witnessed hole open to required depth for cementing.

Well No. 8, special test. T 4-730.

Top of cement plug determined.

Well No. 8, shut-off. T 4-739.

Location of top of cement plug determined.

Well No. 8, supplementary abandon. P 4-766.

Proposal answered with recommendations.

Well No. 8, special test. T 4-739.

Test to determine condition of well.

Well No. 8, special test. T 4-751.

Shooting approved.

Well No. 8, special test. T 4-769.

Company reported location of cement plug.

Well No. 8, special test. T 4-781.

Plugging approved.

Well No. 9, special test. T 4-589.

Mudding approved.

Well No. 9, special test. T 4-613.

Cementing approved.

Well No. 9, shut-off. T 4-628.

Shut-off approved.

Well No. 9, special test. T 4-640.

Cementing approved.

Well No. 9, special test. T 4-648.

Cementing approved.

## Midway Oil Co.—Continued.

- Well No. 9, abandon. P 4-678.  
Proposal approved.
- Well No. 9, special test. T 4-659.  
Plugging approved.
- Well No. 10, abandon. P 4-544.  
Proposal answered with recommendations.
- Well No. 10, special test. T 4-641.  
Depth of hole determined.
- Well No. 10, supplementary abandon. P 4-686.  
Proposal approved.
- Well No. 10, abandon. P 4-687.  
Supplementary proposal answered with recommendations.
- Well No. 11, shut-off. D-918.  
Plugging rejected.
- Well No. 11, abandon. P 4-860.  
Proposal answered with recommendations.
- Well No. 12, abandon. P 4-545.  
Proposal answered with recommendations.
- Well No. 12, supplementary abandon. P 4-782.  
Proposal answered with recommendations.
- Well No. 12, special test. T 4-1155.  
Depth of hole determined.
- Well No. 12, special test. T 4-1167.  
Cementing approved.
- Well No. 12, special test. T 4-1188.  
Plugging approved.
- Well No. 12, special test. T 4-1211.  
Plugging approved.
- Well No. 12, special test. T 4-1127.  
Plugging approved.
- Well No. 12, shut-off. T 4-1128.  
Old shut-off leaking.
- Well No. 12, special test. T 4-1240.  
Plugging approved.
- Well No. 12, special test. T 4-1260.  
Cementing approved.
- Well No. 12, special test. T 4-1267.  
Shooting approved.
- Well No. 50, drill. P 4-1370.  
Proposal approved.
- Well No. 50, shut-off. T 4-1382.  
Passed for production test.
- Well No. 51, drill. P 4-1369.  
Proposal approved.
- Well No. 51, shut-off. T 4-1311.  
Decision withheld.
- Well No. 51, shut-off. T 4-1314.  
Shut-off approved.
- Well No. 57, drill. P 4-855.  
Proposal approved.
- Well No. 57, shut-off. T 4-819.  
Shut-off approved.
- Well No. 58, shut-off. T 4-1245.  
Shut-off approved.
- Well No. 59, shut-off. T 4-1246.  
Shut-off approved, as result of production test.

## Midway Oil Co.—Continued.

Well No. 63, drill. P 4-689.

Proposal approved.

Well No. 63, shut-off. T 4-714.

Shut-off approved.

Well No. 64, shut-off. T 4-604.

Shut-off approved.

Well No. 66, drill. P 4-589.

Proposal approved.

Well No. 66, shut-off. T 4-715.

Shut-off approved.

Well No. 67, drill. P 4-923.

Proposal approved.

Well No. 67, shut-off. T 4-881.

Shut-off approved.

Well No. 69, shut-off. T 4-1244.

Passed for production test.

## "Webster."

Well No. 14, drill. P 4-1311.

Proposal approved.

Well No. 14, shut-off. T 4-1029.

Passed for production test.

Well No. 15, drill. P 4-1288.

Proposal approved.

Well No. 15, shut-off. T 4-1243.

Shut-off approved.

## SECTION 36.

## Ethel D. Oil Co.

Well No. 1, supplementary abandon. P 4-1192.

Proposal approved conditionally.

Well No. 20, drill. P 4-882.

Proposal approved.

Well No. 20, shut-off. T 4-898.

Shut-off approved.

Well No. 34, shut-off. T 4-665.

Shut-off approved.

Well No. 35, drill. P 4-612.

Proposal approved.

Well No. 35, shut-off. T 4-574.

Passed for production test.

Well No. 36, drill. P 4-665.

Proposal answered with recommendations as to depth of shut-off.

Well No. 36, shut-off. T 4-728.

Passed for production test.

Well No. 36, redrill. P 4-1032.

Proposal approved.

Well No. 36, shut-off. T 4-989.

Decision withheld.

Well No. 37, drill. P 4-1105.

Proposal answered with recommendations as to depth of shut-off.

Well No. 37, supplementary drill. P 4-1159.

Proposal approved conditionally.

Well No. 37, shut-off. T 4-1083.

Shut-off approved conditionally.

Well No. 38, drill. P 4-1291.

Proposal approved conditionally.

Well No. 38, shut-off. T 4-1319.

Shut-off approved.

## Interstate Oil Co.

Well No. 3, special test. D-932.

Cementing approved.

Well No. 4, drill. P 4-1347.

Proposal approved.

## Standard Oil Co., "M. J. M. &amp; M."

Well No. 17, redrill. P 4-602.

Proposal approved conditionally.

Well No. 17, shut-off. T 4-590.

Shut-off approved.

Well No. 24, shut-off. T 4-508.

Additional test recommended.

Well No. 24, shut-off. T 4-509.

Passed for production test.

Well No. 24, production test. T 4-1011.

Shut-off approved.

Well No. 28, redrill. P 4-595.

Proposal approved.

Well No. 42, drill. P 4-522.

Proposal answered with recommendations.

Well No. 42, shut-off. T 4-593.

Shut-off approved.

Well No. 43, drill. P 4-530.

Proposal approved.

Well No. 43, shut-off. T 4-649.

Shut-off approved.

Well No. 44, deepen. P 4-577.

Proposal approved.

Well No. 44, shut-off. T 4-655.

Passed for production test.

Well No. 44, production test. T 4-985.

Shut-off approved.

Well No. 45, drill. P 4-638.

Proposal approved.

Well No. 45, shut-off. T 4-682.

Shut-off approved.

Well No. 45, shut-off. T 4-682.

Shut-off approved.

Well No. 47, drill. P 4-722.

Proposal rejected.

Well No. 47, shut-off. T 4-924.

Shut-off rejected.

Well No. 47, shut-off. T 4-925.

Passed for production test.

Well No. 47, supplementary drill. P 4-989.

Proposal approved.

Well No. 48, drill. P 4-667.

Proposal answered with recommendations.

Well No. 48, shut-off. T 4-790.

Shut-off approved.

Well No. 48, special test. T 4-879.

Cementing approved.

Well No. 48, shut-off. T 4-912.

Additional test recommended.

Well No. 48, shut-off. T 4-913.

Additional test recommended.

Well No. 48, shut-off. T 4-926.

Shut-off rejected.

## Standard Oil Co., "M. J. M. &amp; M."—Continued.

Well No. 48, shut-off. T 4-952.

Shut-off approved conditionally.

Well No. 48, supplementary drill. P 4-1306.

Proposal approved.

Well No. 48, shut-off. T 4-1331.

Test inconclusive.

Well No. 48, shut-off. T 4-1371.

Shut-off unsatisfactory.

Well No. 49, drill. P 4-674.

Proposal approved.

Well No. 49, deepen. P 4-747.

Proposal approved.

Well No. 49, shut-off. T 4-771.

Shut-off unsatisfactory.

Well No. 49, supplementary drill. P 4-904.

Proposal approved conditionally.

Well No. 49, shut-off. T 4-920.

Passed for production test.

Well No. 49, redrill. T 4-1210.

Proposal approved.

Well No. 49, special test. T 4-1121.

Cementing approved.

Well No. 49, shut-off. T 4-1301.

Additional test recommended.

Well No. 49, shut-off. T 4-1302.

Test inconclusive.

Well No. 49, shut-off. T 4-1303.

Passed for production test.

Well No. 50, drill. P 4-721.

Proposal answered with recommendations as to shut-off.

Well No. 50, supplementary drill. P 4-967.

Proposal approved.

Well No. 50, supplementary drill. P 4-991.

Proposal answered with recommendations.

Well No. 50, shut-off. T 4-968.

Decision withheld pending receipt of records.

Well No. 50, supplementary drill. P 4-1039.

Proposal approved.

Well No. 50, shut-off. T 4-988.

Shut-off approved.

Well No. 51, drill. P 4-723.

Proposal approved with recommendations.

Well No. 51, shut-off. T 4-821.

Shut-off approved.

Well No. 52, drill. P 4-979.

Proposal approved.

Well No. 52, shut-off. T 4-986.

Shut-off rejected.

Well No. 52, supplementary drill. P 4-1035.

Proposal rejected.

Well No. 52, shut-off. T 4-1037.

Shut-off rejected.

Well No. 52, special test. T 4-1042.

Circulation obtained.

Well No. 52, special test. T 4-1061.

Cementing witnessed.

Standard Oil Co., "M. J. M. & M." Continued.

Well No. 52, shut-off. T 4-1112.

Shut-off unsatisfactory.

Well No. 52, supplementary drill. P 4-1260.

Proposal approved conditionally.

Well No. 52, special test. T 4-1168

Cementing witnessed.

Well No. 52, shut-off. T 4-1230.

Shut-off rejected.

Well No. 52, shut-off. T 4-1308.

Test inconclusive.

Well No. 52, shut-off. T 4-1312.

Test inconclusive.

Well No. 52, redrill. P 4-1440.

Proposal approved.

### DECISIONS.

#### KERN RIVER FIELD.

T. 28 S., R. 27 E., M.D.B. & M.

#### SECTION 25.

Clampitt Oil Co.

Well No. 1, redrill. P 4-95.

Proposal answered with recommendations.

Well No. 2, redrill. P 4-96.

Proposal approved conditionally.

Well No. 6, redrill. P 4-97.

Proposal approved conditionally.

Well No. 6, shut-off. T 4-103.

Shut-off approved conditionally.

Fox & Garrett Oil Co.

Well No. 1, redrill. P 4-88.

Proposal approved conditionally.

Well No. 5, redrill. P 4-71.

Proposal answered with recommendations.

Well No. 5, shut-off. T 4-67.

Shut-off approved conditionally.

#### SECTION 27.

Standard Oil Co.

Well No. 1, redrill. P 4-54.

Proposal answered with recommendations.

Well No. 3, production test. T 4-57.

Test unsatisfactory; remedial work recommended.

Well No. 3, plug. P 4-81.

Proposal approved.

Well No. 3, redrill. P 4-125.

Proposal approved.

Well No. 4, drill. P 4-47.

Proposal approved with recommendations.

Well No. 4, shut-off. T 4-77.

Test inconclusive.

Well No. 4, shut-off. T 4-90.

Production test satisfactory.

Well No. 4, deepen. P 4-121.

Proposal approved conditionally.

Well No. 4, shut-off. T 4-95.

Test unsatisfactory.

Well No. 4, shut-off. T 4-96.

Test unsatisfactory.

## Standard Oil Co. Continued.

Well No. 4, shut-off. T 4-97.

Shut-off approved.

## SECTION 29.

## Associated Oil Co., "Brown."

Well No. 1, shut-off. T 4-13.

Shut-off rejected.

Well No. 1, redrill. P 4-25.

Proposal answered with recommendations.

Well No. 1, supplementary redrill. P 4-39.

Proposal approved.

Well No. 1, redrill. P 4-77.

Proposal approved.

Well No. 1, shut-off. T 4-66.

Test unsatisfactory.

Well No. 1, supplementary redrill. P 4-89.

Proposal answered with recommendations.

Well No. 1, special test. T 4-71.

Mudding approved.

Well No. 1, special test. T 4-72.

Cementing approved.

Well No. 1, shut-off. T 4-88.

Shut-off rejected.

Well No. 1, supplementary drill. P 4-115.

Proposal approved conditionally.

## SECTION 36.

## Clampitt Oil Co.

Well No. 3, shut-off. T 4-8.

Shut-off approved.

Well No. 4, drill. P 4-42.

Proposal rejected.

Well No. 4, shut-off. T 4-37.

Shut-off approved with the understanding that another shut-off would be made above oil sands.

Well No. 4, special test. T 4-44.

Cementing unsatisfactory.

Well No. 4, redrill. P 4-87.

Proposal approved with recommendations.

## Tejon Oil Co.

Well No. 3, redrill. P 4-71.

Proposal approved as a temporary measure.

Well No. 6, shut-off. T 4-35.

Shut-off approved conditionally.

Well No. 6, production test. T 4-61.

Decision deferred.

Well No. 10, redrill. P 4-4.

Proposal approved.

Well No. 10, shut-off. T 4-6.

Passed for production test.

## Traffic Oil Co.

Well No. 8, alter casing. P 4-58.

Proposal approved.

Well No. 10, alter casing. P 4-59.

Proposal answered with recommendations.

Well No. 11, alter casing. P 4-60.

Proposal approved.

## T. 28 S., R. 28 E., M.D.B &amp; M.

## SECTION 19.

## Traffic Oil Co.

Well No. 20-A, redrill. P 4-69.

Work approved as temporary measure.

Well No. 38, shut-off. P 4-60.

Production test satisfactory.

## SECTION 20.

## Boston Petroleum Co.

Well No. 3-A, redrill. P 4-82.

Proposal answered with recommendations.

Well No. 3-A, supplementary redrill. P 4-101.

Proposal approved conditionally.

Well No. 3-A, special test. T 4-80.

Cementing approved.

Well No. 3-A, shut-off. T 4-86.

Shut-off approved.

Well No. 16, shut-off. T 4-2.

Shut-off approved.

Well No. 17, shut-off. T 4-9.

Shut-off approved.

Well No. 18, drill. P 4-105.

Proposal approved conditionally.

Well No. 18, shut-off. T 4-85.

Shut-off approved.

Well No. 19, drill. P 4-120.

Proposal approved conditionally.

Well No. 19, shut-off. T 4-94.

Shut-off approved.

Well No. 20, drill. P 4-126.

Proposal approved conditionally.

## SECTION 28.

## Stauffer Oil Co.

Well No. 9, redrill. P 4-90.

Proposal approved conditionally.

## SECTION 29.

## Virginia Oil Co.

Well No. 17, redrill. P 4-108.

Proposal answered with recommendations.

Well No. 17, shut-off. T 4-84.

Shut-off approved with reservations.

Well No. 33, drill. P 4-3.

Proposal answered with recommendations.

Well No. 33, shut-off. T 4-5.

Shut-off approved.

Well No. 34, drill. P 4-37.

Proposal approved.

Well No. 34, shut-off. T 4-26.

Shut-off approved.

## SECTION 30.

## Associated Oil Co., "Luck."

Well No. 13, shut-off. T 4-65.

Production test satisfactory.

Well No. 17, shut-off. T 4-7.

Shut-off approved.

## McQuigg Bros.

Well No. 3, abandon. P 4-20.

Proposal answered with recommendations.

## Traffic Oil Co.

Well No. 1, redrill. P 4-56.

Proposal approved conditionally.

Well No. 5, drill. DD-499.

Proposal approved.

Well No. 5, shut-off. T 4-4.

Shut-off satisfactory.

## SECTION 31.

## Associated Oil Co., "Clarence."

Well No. 6, redrill. P 4-16.

Proposal answered with recommendations.

Well No. 7, redrill. P 4-34.

Proposal answered with recommendations.

## Associated Oil Co., "Sterling."

Well No. 19, abandon. P 4-117.

Proposal answered with specifications.

Well No. 22, abandon. P 4-116.

Proposal answered with specifications.

## Calex Oil Co.

Well No. 2, redrill. P 4-17.

Proposal approved.

Well No. 2, shut-off. T 4-19.

Shut-off approved conditionally.

## Calloma Oil Co.

Well No. 4, redrill. P 4-24.

Proposal approved with recommendations.

## Peerless Oil Co.

Well No. 52, alter casing. P 4-45.

Proposal approved.

Well No. 57, redrill. P 4-8.

Proposal approved.

Well No. 57, production test. T 4-59.

Decision deferred.

Well No. 72, shut-off. D-439.

Shut-off approved.

Well No. 73, drill. P 4-7.

Proposal approved.

Well No. 73, shut-off. T 4-10.

## Sovereign Oil Co.

Well No. 11, shut-off. T 4-1.

Shut-off approved.

## SECTION 32.

## Standard Oil Co., "Monte Cristo No. 2."

Well No. 6, redrill. P 4-14.

Proposal answered with recommendations.

Well No. 7, redrill. P 4-70.

Proposal answered with recommendations.

Well No. 11, redrill. P 4-35.

Proposal answered with recommendations.

## Associated Oil Co., "Omar."

Well No. 3, redrill. P 4-85.

Proposal answered with recommendations.

Well No. 3, shut-off. T 4-89.

Shut-off approved.

## SECTION 33.

Kern River Oilfields of California, Ltd.

Well No. 2-A, redrill. P 4-36.

Proposal approved with recommendations.

Well No. 2-A, supplementary redrill. P 4-113.

Proposal approved with recommendations.

Well No. 2-B, redrill. P 4-128.

Proposal approved with recommendations.

T. 29 S., R. 28 E., M.D.B. & M

## SECTION 2.

Petroleum Development Co.

Well No. 17, drill. P 4-23.

Proposal approved.

Well No. 18, drill. P 4-91.

Proposal approved conditionally.

## SECTION 3.

Petroleum Development Co., "Elwood."

Well No. 21, drill. P 4-78.

Proposal approved.

Well No. 21, shut-off. T 4-51.

Shut-off approved.

Well No. 22, drill. P 4-110.

Proposal approved.

Petroleum Development Co., "K. C."

Well No. 39, drill. P 4-79.

Proposal approved.

Well No. 39, shut-off. T 4-75.

Shut-off approved.

Well No. 40, drill. P 4-124.

Proposal approved.

Well No. 40, shut-off. T 4-92.

Shut-off approved.

Well No. 40, shut-off. T 4-93.

Shut-off approved.

Well No. 41, drill. P 4-111.

Proposal approved.

## SECTION 4

Alma Oil Co.

Well No. 2, Jr., special test. T 4-14.

Fluid level determined.

Well No. 2, Jr., shut-off. T 4-15.

Test inconclusive.

Well No. 2, Jr., shut-off. T 4-16.

Test inconclusive.

Well No. 2, Jr., shut-off. T 4-38.

Test inconclusive.

Well No. 2, Jr., special test. T 4-50.

Fluid level determined.

Well No. 2, Jr., production test. T 4-98.

Test inconclusive.

Apollo Oil Co.

Well No. 1, shut-off. T 4-24.

Shut-off approved.

Well No. 1, redrill. P 4-63.

Proposal approved.

## Apollo Oil Co.—Continued.

Well No. 2, redrill. P 4-15.

Proposal approved.

Well No. 2, abandon. P 4-21.

Proposal answered with recommendations.

## Associated Oil Co., "Gold Standard."

Well No. 4, redrill. P 4-86.

Proposal approved.

## East Puente Oil Co.

Well No. 1, redrill. P 4-13.

Proposal approved.

## Revenue Oil Co.

Well No. 18, drill. P 4-103.

Proposal approved.

Well No. 18, shut-off. T 4-87.

Shut-off approved.

## SECTION 5.

## Associated Oil Co., "San Joaquin."

Well No. 5, abandon. P 4-61.

Decision withheld pending receipt of records.

Well No. 5, abandon. P 4-75.

Proposal answered with recommendations.

## Del Rey Oil Co.

Well No. 5, redrill. P 4-70.

Proposal answered with recommendations

Well No. 5, special test. T 4-54.

Shoe of water string located.

Well No. 5, special test. T 4-62.

Cementing not approved.

Well No. 5, shut-off. T 4-68.

Decision deferred.

Well No. 6, redrill. P 4-29.

Proposal approved.

Well No. 6, shut-off. P 4-17.

Shut-off approved.

Well No. 6, special test. T 4-22.

Cementing approved.

Well No. 6, shut-off. T 4-33.

Shut-off approved.

Well No. 7, redrill. P 4-55.

Proposal rejected with recommendations.

Well No. 7, special test. T 4-47.

Cementing approved.

Well No. 7, shut-off. T 4-69.

Test inconclusive.

Well No. 9, redrill. P 4-18.

Proposal approved.

Well No. 10, redrill. P 4-9.

Proposal approved.

Well No. 12, redrill. P 4-50.

Proposal rejected.

Well No. 13, drill. P 4-122.

Proposal approved.

Well No. 14, drill. P 4-123.

Proposal approved.

Well No. 14, shut-off. T 4-102.

Shut-off approved.

## Del Rey Oil Co., "West."

Well No. 1, redrill. P 4-67.

Proposal approved conditionally.

Well No. 1, shut-off. T 4-48.

Shut-off approved.

Well No. 3, redrill. P 4-28.

Proposal approved.

Well No. 3, supplementary redrill.. P 4-44.

Proposal approved.

Well No. 3, special test. T 4-34.

Cementing approved.

Well No. 3, shut-off. T 4-64.

Shut-off rejected.

Well No. 5, redrill. P 4-2.

Proposal rejected.

## Standard Oil Co., "Monte Cristo No. 1."

Well No. 7, redrill. P 4-57.

Proposal answered with recommendations.

Well No. 7, redrill. P 4-72.

Proposal answered with recommendations.

Well No. 7, special test. T 4-40.

Additional work recommended.

Well No. 7, special test. T 4-49.

Cementing unsatisfactory due to insufficient mudding.

Well No. 7, shut-off. T 4-53.

Decision withheld.

Well No. 7, special test. T 4-63.

Mudding approved.

Well No. 14, redrill. P 4-33.

Proposal approved.

Well No. 23, redrill. P 4-32.

Proposal approved.

Well No. 23, supplementary redrill. P 4-48.

Proposal approved.

Well No. 23, special test. T 4-30.

Cementing unsuccessful.

Well No. 23, special test. T 4-31.

Cementing approved.

Well No. 23, shut-off. T 4-41.

Shut-off approved.

Well No. 48, redrill. P 4-31.

Proposal approved with recommendations.

Well No. 51, abandon. P 4-12.

Proposal answered with recommendations.

Well No. 58, redrill. P 4-30.

Proposal approved with recommendations.

Well No. 58, shut-off. T 4-21.

Shut-off approved.

Well No. 62, redrill. P 4-10.

Proposal approved.

Well No. 64, supplementary redrill. P 4-46.

Proposal approved.

Well No. 69, drill. P 4-6.

Proposal approved.

Well No. 69, shut-off. T 4-11.

Shut-off approved with reservations.

Well No. 69, shut-off. T 4-18.

Shut-off approved.

## SECTION 6.

## Enos Oil Co.

- Well No. 18, redrill. P 4-107.  
Proposal approved.
- Well No. 22, redrill. P 4-41.  
Proposal answered with recommendations.
- Well No. 22, shut-off. T 4-32.  
Shut-off unsatisfactory.
- Well No. 22, special test. T 4-39.  
Cementing approved conditionally.
- Well No. 22, shut-off. T 4-45.  
Shut-off approved conditionally.
- Well No. 23, drill. P 4-83.  
Proposal approved.
- Well No. 23, supplementary drill. P 4-102.  
Proposal approved conditionally.
- Well No. 23, special test. T 4-79.  
Cementing approved.
- Well No. 23, shut-off. T 4-82.  
Shut-off approved.

## SECTION 8.

## Frank May, "Golden Rod."

- Well No. 2, redrill. P 4-62.  
Proposal rejected.
- Well No. 2, redrill. P 4-66.  
Proposal approved conditionally.
- Well No. 2, shut-off. T 4-42.  
Test satisfactory.
- Well No. 2, special test. T 4-43.  
Cementing unsatisfactory.
- Well No. 2, shut-off. T 4-52.  
Passed for production test.
- Well No. 2, production test. T 4-101.  
Shut-off approved.

## Frank May, "Homer."

- Well No. 4, redrill. P 4-73.  
Proposal approved conditionally.
- Well No. 4, special test. T 4-55.  
Cementing approved.
- Well No. 4, shut-off. T 4-56.  
Decision deferred.
- Well No. 4, production test. T 4-100.  
Shut-off approved.

## Prairie Oil Co.

- Well No. 1, abandon. P 4-40.  
Proposal answered with specifications for abandonment.

## SECTION 9.

## Junction Oil Co.

- Well No. 1, redrill. P 4-87.  
Consideration withheld pending receipt of records.
- Well No. 1, redrill. P 4-92.  
Approval withheld.
- Well No. 3, redrill. P 4-98.  
Proposal answered with recommendations.
- Well No. 3, supplementary redrill. P 4-106.  
Proposal answered with recommendations.

## Junction Oil Co.—Continued.

Well No. 3, shut-off. T 4-81.

Shut-off approved.

Well No. 4, redrill. P 4-119.

Proposal approved.

Well No. 4, supplementary redrill. P 4-129.

Proposal approved.

Well No. 6, redrill. P 4-93.

Proposal answered with recommendations.

Well No. 6, special test. T 4-73.

Shoe of water string located.

Well No. 6, shut-off. T 4-74.

Shut-off approved.

Well No. 8, redrill. P 4-114.

Proposal approved conditionally.

Well No. 8, supplementary redrill. P 4-118.

Proposal approved.

Well No. 8, shut-off. T 4-91.

Shut-off rejected.

Well No. 8, special test. T 4-99.

Mudding and cementing approved.

Well No. 10, drill. P 422.

Proposal approved.

Well No. 10, shut-off. T 4-23.

Shut-off rejected.

Well No. 10, shut-off. T 4-27.

Shut-off unsatisfactory.

Well No. 10, supplementary drill. P 4-43.

Proposal answered with recommendations.

Well No. 10, alter casing. P 4-53.

Proposal approved.

Well No. 10, shut-off. T 4-27.

Test inconclusive.

Well No. 11, drill. P 4-38.

Proposal approved.

Well No. 11, shut-off. T 4-25.

Shut-off approved.

## Petroleum Development Co.

Well No. 9, redrill. P 4-5.

Proposal approved.

Well No. 9, shut-off. T 4-40.

Shut-off approved.

## Section Five Oil Co.

Well No. 2, redrill. P 4-80.

Proposal approved conditionally.

Well No. 2, shut-off. T 4-76.

Decision withheld.

Well No. 2, redrill. P 4-100.

Proposal approved.

Well No. 3, redrill. P 4-112.

Proposal answered with recommendations.

Well No. 5, redrill. P 4-11.

Proposal approved.

Well No. 5, deepen. P 4-19.

Proposal approved conditionally.

## SECTION 10.

## Gray Heirs.

Well No. 30, drill. P 4-49.

Proposal approved.

Well No. 30, shut-off. T 4-36.

Shut-off approved.

Well No. 30, abandon. P 4-80.

Proposal approved conditionally.

Well No. 31, drill. P 4-65.

Proposal approved.

Well No. 31, shut-off. T 4-46.

Shut-off approved.

Well No. 32, drill. P 4-84.

Proposal answered with recommendations.

Well No. 32, shut-off. T 4-70.

Shut-off approved.

Well No. 33, drill. P 4-104.

Proposal approved.

Well No. 33, shut-off. T 4-83.

Shut-off approved.

Well No. 34, drill. P 4-127.

Proposal approved conditionally.

## Petroleum Development Co.

Well No. 5, redrill. P 4-68.

Proposal answered with recommendations.

Well No. 6, drill. P 4-1.

Proposal approved.

Well No. 6, shut-off. T 4-3.

Shut-off approved.

Well No. 7, drill. P 4-27.

Proposal approved.

Well No. 7, shut-off. T 4-20.

Shut-off approved.

Well No. 8, drill. P 4-26.

Proposal approved.

Well No. 8, shut-off. T 4-29.

Shut-off approved.

## "WILDCAT" WELLS.

T. 26 S., R. 26 E., M.D.B. & M.

## SECTION 11.

## Hale Syndicate.

Well No. 1, redrill. P 4-52.

Proposal approved.

Well No. 1, shut-off. T 4-41.

Test unsatisfactory.

Well No. 1, supplementary redrill. P 4-74.

Proposal rejected.

Well No. 1, special test. T 4-58.

Witnessed work indicating that thorough tests recommended by this department, of formations logged as oil-bearing, were not being made.

T. 26 S., R. 27 E., M.D.B. &amp; M.

## SECTION 16.

Root, Shoup &amp; Millikin.

Well No. 1, drill. P 4-109.

Proposal approved.

T. 30 S., R. 30 E., M.D.B. &amp; M.

## SECTION 7.

Visalia Midway Oil Co., No. 2.

Well No. 1, drill. P 4-64.

Proposal approved.

## CHAPTER VI.

## FRESNO, KINGS AND OTHER COUNTIES.

By R. D. BUSH, Deputy Supervisor.

The work during the past year for this district has been handled by the deputy, one inspector, and one office assistant. The number of field operations was about the same as for the preceding year, the increase in the drilling of new wells being offset by a decrease in redrilling and deepening. In general there has been no decided change in water conditions in the older parts of the field where those conditions are likely to be most serious. Extensive summaries of production reports for the past two years have been prepared with show for a few companies marked increase in the amount of water produced and for others a corresponding decrease.

No new formal complaints against neighbors' wells have been filed with the bureau and the few informal complaints filed have been amicably settled by calling attention to the unsatisfactory conditions and showing the benefit to be derived by both parties by remedying these conditions. When differences of opinion between operators and this office have arisen regarding the protection of oil sands and drilling methods, they have been agreeably settled by correspondence or discussion which brought out a more complete knowledge of facts regarding underground conditions, and in some cases suggestions for the use of untried methods. Cordial co-operation between the operator and this office has been the rule in carrying on the work of this department.

The following tabulations show the number of wells in this district, the average number producing, their production, logs filed, and details of the notices received and reports made by this office:

	Number
New wells, wells drilled, abandoned wells.....	1,648
Logs filed.....	1,415
Graphic logs.....	924
Producing wells.....	1,057
Average daily production, barrels oil.....	45,044
Average daily production, barrels water.....	10,197
Average daily per well, barrels oil.....	42.5
Average daily per well, barrels water.....	9.6
Per cent water.....	18.4

	Notices	Reports
New wells.....	123	137
Test water shut-off.....	180	208
Deepened or redrilled.....	174	190
Abandonment.....	36	18

Of the 174 wells in the above tabulation which were deepened or redrilled, 64 were reperforated, redrilled or deepened to increase production, 90 were redrilled or partly plugged to shut off water, and in 20 wells packers were set to shut off water. The column headed "Test Water Shut-Off" includes reports on inspection of plugs in abandonment as well as the ordinary tests for shut off of water which with the addition of the work in the field involved the traveling of over 12,000 auto miles.

The following data, compiled from the production reports covering the past fiscal year, show average production per well and percentages of idle time and productive operation. The minimum number of wells reported producing was 954, and the maximum number 1174, which includes new wells brought in at various times during the year, and which are, of course, reckoned as nonoperative during the period of the year before being put to producing:

Basis 1057.55 well (mean) pumping a total of 349,689 days—	
Number of days productive operation per well for year-----	330.66
Percentage of time of productive operation-----	90.6
Percentage of idle time-----	9.4
Average production per pumping day—bbl. oil-----	47.01
Average production per pumping day—bbl. water-----	10.64
<hr/>	
Total bbl. fluid-----	57.65
<hr/>	
Basis 1057.55 wells 365 days—bbl. oil-----	42.58
Bbl. water-----	9.64
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Total bbl. fluid-----	52.22
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Basis 1174 wells—	
Number of days productive operation per well-----	297.9
Percentage of time of productive operation-----	81.61
Percentage of idle time-----	18.39

During the year this office was able to supply information to several operators which was helpful in prevention of damage to oil deposits on their own and neighbors' properties. Some of the instances follow:

The Shell Company drilled a well on Section 29, T. 19 S., R. 15 E., and estimated the depth to the top of oil sand 45' deeper than the estimate by this office. The casing was cemented according to the company's estimate but the cement job failed. After correspondence and discussion the company agreed to put a plug in the bottom of the casing and perforate at 40' above the cementing point. This test was made and proved conclusively the presence of an oil sand at or near the point of perforation, giving valuable information for use in future drilling.

A notice was received from the Pantheon Oil Company on Section 32, T. 19 S., R. 15 E., which stated that a well just completed was producing all water and proposing to test the water string for top water. An analysis of the water was also submitted. The company was advised

that the analysis showed bottom water and that a lower sand was probably the source. Subsequent work indicated that this was the case.

The Maine State Oil Company proposed to drill a new well on Section 31, T. 19 S., R. 15 E., and cement the water string below some oil sands which are not highly productive but which are open in other wells. After this was called to the company's attention the plan of drilling was changed so that these upper sands were protected from water with mud-fluid.

The Union Oil Company on Section 8, T. 20 S., R. 15 E., proposed to shut off water at an old well by cementing the 6 $\frac{1}{4}$ " oil string below a supposed water sand, and to use 4 $\frac{1}{2}$ " casing for the oil string. This supposed water sand is open in neighboring wells and it was recommended that the water string be tested for a leak. This was done and a hole was found in the 8 $\frac{1}{4}$ " casing. Most of the water was shut off by placing a packer on the 6 $\frac{1}{4}$ " oil string, thereby saving a string of casing.

### DECISIONS.

#### COALINGA FIELD.

T. 15 S., R. 12 E., M.D.B. & M.

##### SECTION 21.

Kern-Pucheu Oil Co.

Well No. 1, abandon. P 5-332.

An old well near Mendota. Company's proposal to remove casing was approved, recommending certain shooting and plugging for the protection of the oil sands logged.

T. 19 S., R. 15 E., M.D.B. & M.

##### SECTION 2.

Imperial Oil Company.

Well No. 6, plug bottom. P 5-56.

Well was drilled ahead to a depth of 2978' and produced nothing but water. Approved proposal to plug up from the bottom, testing each sand separately for the source of the water.

Well No. 6, cement deeper. P 5-137.

After testing, water was located between 2925' and 2930'; the proposal to loosen 6 $\frac{1}{4}$ " and after mudding carry it down and cement at 2935' to test out the lower sands was approved.

Well No. 6, recement. P 5-252.

Approved proposal to recement 6 $\frac{1}{4}$ " by first pumping mud back of the casing and following it with cement.

Well No. 6, redrill. P 5-314. (By Standard Oil Company.)

Approved proposal to plug bottom of the well and test various sands above the bottom of the 8 $\frac{1}{4}$ " and above bottom of the 10" casing for oil.

Standard Oil Company (formerly General Petroleum Corporation).

Well No. 8, commence drilling. P 5-205.

Recommended cementing 12 $\frac{1}{2}$ " at about 1825' instead of 1775', as proposed.

Well No. 8, supplementary commence drilling. P 5-230.

Approved proposal to use 10" 40-lb. casing instead of 12 $\frac{1}{2}$ ", as originally proposed, and recommended that the well be completed at about 1860' instead of 2080' as proposed.

## Standard Oil Co.—Continued.

Well No. 8, shut-off. T 5-155.

On account of 40' of water which entered the hole in eleven hours, which probably came from the formation below the casing, it was recommended that the well be drilled ahead and further bailing tests made.

Well No. 9, production test. T 5-22.

Test of lead-line sample indicated that all water was shut off.

Well No. 10, commence drilling. P 5-246.

Recommended cementing 10" casing at 2120' instead of 1945' as proposed.

Well No. 10, shut-off. T 5-172.

Test of water shut-off satisfactory.

Well No. 10, commence drilling. P 5-318.

After a criticism by the Standard Oil Company of report recommending cementing below the oil sand which was found at 2090', it was found that the information given by the company as to the location and elevation of this well was incorrect. The well was surveyed by this department, and from the correct data an estimate was made which agreed within 4' with the result as found by drilling. This report is made to correct a previous opinion that the oil sand found at 2090' was one heretofore shut off by surrounding wells.

Well No. 11, commence drilling. P 5-281.

Proposed depth of water shut-off approved.

Well No. 11, shut-off. T 5-200.

Test of water shut-off satisfactory.

Well No. 12, commence drilling. P 5-331.

Recommended cementing 10" casing at about 1730' instead of 1710' as proposed.

Well No. 12, shut-off. T 5-211.

10' casing was cemented at 1742'. Test of water shut-off satisfactory.

Well No. 13, commence drilling. P 5-340.

Proposed depth of water shut-off approved.

Well No. 15, plug bottom. P 5-23. (By General Petroleum Corporation.)

Approved proposal to plug off bottom water and recommended drilling out cement to at least 2535'. The work of plugging was done prior to filing notice.

Well No. 15, plug bottom. P 5-171. (By S. O. Co.)

Approved proposal to again plug off bottom water.

Well No. 15, test for bottom water. T 5-144.

A bailing test indicated that the supposed bottom water had been exhausted.

Well No. 15, plug bottom. P 5-307. Approved proposal to plug bottom to shut off water which appears to come in pockets.

Well No. 33, cement deeper. P 5-79. (By G. P. Corporation.)

After cementing the 10" at 2138' a water sand was encountered at 2140'

Approved proposal to cement the 8½" casing below this sand.

Well No. 33, shut-off. T 5-66. (By G. P. Corporation.)

8½" casing cemented at 2195'. Test of water shut-off satisfactory.

## SECTION 10.

Shell Company of California.

Well No. 2, production test. T 5-39.

A lead-line sample indicated that water is shut off.

Coalinga Midland Oil Company.

Well No. 1, abandon. P 5-2 (by M. C. Kyle).

Approved proposal to abandon, recommending certain depths for plugging.

Derrick soon afterward burned down and no work has been done at this well.

## SECTION 11.

Southern Pacific Company, Fuel Oil Department.

Well No. 2, redrill. P 5-256.

Recommended plugging bottom instead of redrilling water string as proposed.

Well No. 48, commence drilling. P 5-135.

Proposed depth of water shut-off approved.

## Southern Pacific Co., Fuel Oil Department—Continued.

Well No. 48, shut-off. T 5-112.

Test of water shut-off satisfactory.

Well No. 48, cement deeper. P 5-186.

A sand carrying a small amount of water was encountered below the water string. Approved proposal to cement 8½" liner below this sand.

Well No. 48, plug bottom. P 5-232.

Approved proposal to plug bottom. Recommended some replugging, which was done prior to filing notice.

Well No. 49, commence drilling. P 5-165.

Recommended cementing not deeper than 1370' instead of 1390' as proposed.

Well No. 49, supplementary to commence drilling. P 5-187.

Due to a water sand located in Well No. 48, the proposal to cement at 1403' instead of 1370', as previously recommended, was approved.

Well No. 49, shut-off. T 5-127.

Test of water shut-off satisfactory.

Well No. 49, plug bottom. P 5-222.

Approved proposal to plug off bottom water.

Well No. 50, commence drilling. P 5-192.

Depth of water shut-off approved.

Well No. 50, deepen. P 5-223.

After drilling ahead of water string, sand and oil heaved up into casing.

Approved proposal to drill ahead and make production test.

Well No. 50, plug bottom. P 5-244.

During drilling each sand was tested separately and water encountered at the bottom. Approved proposal to plug off bottom sand.

Well No. 51, commence drilling. P 5-84.

"Red rock" was reported by the company at 1240'. On this account it was recommended that water be shut off at 1840' instead of 1879', as recommended previously.

Well No. 51, cement deeper. P 5-121.

The well was cemented at 1823', and a water sand encountered below the water string. Approved proposal to cement 8½" casing below this sand.

Well No. 51, shut-off. T 5-87.

Test of water shut-off satisfactory.

Well No. 52, shut-off. T 5-88.

Test showed that 75' of sulphur water entered the hole in seventeen hours. Approved proposal to drill into next sand and bail for test.

Well No. 53, supplementary commence drilling. P 5-48.

Due to an error in the elevation of this well, a revised estimate of the depth of shut-off was made.

Well No. 53, shut-off. T 5-61.

Test of water shut-off satisfactory.

Well No. 53, plug bottom. P 5-168.

Approved proposal to plug off bottom water.

Well No. 79, commence drilling. P 5-214.

Proposed depth of water shut-off approved.

Well No. 79, shut-off. T 5-163.

This test and later ones showed that 90' of sulphur water entered the hole every twenty-four hours. The proposal to drill into the next sand and test same by bailing was approved.

Well No. 79, cement deeper. P 5-274.

Approved proposal to cement 8½" casing below water sand.

Well No. 79, shut-off. T 5-183.

Test of water shut-off satisfactory.

Well No. 86, commence drilling. P 5-242.

Proposed depth of water shut-off approved.

## Southern Pacific Co., Fuel Oil Department—Continued.

Well No. 86, shut-off. T 5-193.

Test of water shut-off satisfactory.

Well No. 93, commence drilling. P 5-263.

Proposed depth of water shut-off approved.

Well No. 100, commence drilling. P 5-291.

Proposed depth of water shut-off approved.

Well No. 107, commence drilling. P 5-290.

Proposed depth of water shut-off approved.

## SECTION 12.

## Associated Oil Company.

Well No. 3, commence drilling. P 5-134.

Recommended cementing at 2900' instead of 3050' as proposed. Requested notification of depth of "red rock" for revision of point of water shut-off.

Well No. 3, supplementary commence drilling. P 5-190.

As indicated by the depth of "red rock," it was recommended that water be shut off at 3043'.

Well No. 3, shut-off. T 5-142.

Test showed a level of water in the casing of 318'. It was concluded that the source of the water was the formation below the shoe of the 10".

Well No. 3, cement deeper. P 5-221.

10" casing was cemented at 3025', and it was reported by the company that a water sand was encountered immediately below the shoe of the 10". Approved proposal to cement 8½" casing in the next shale below 3030'.

Well No. 3, shut-off. T 5-164.

Test showed that 45' of water entered the hole in 17 hours, showing that a partial formation shut-off with the 8½" had been made. Proposal to drill ahead and test the sands below was approved, with the understanding that a permanent shut-off would be made later should the well show an excessive amount of water.

Well No. 3, recement. P 5-286.

The partial shut-off with 8½" was found to be unsatisfactory and the proposal to recement same was approved.

Well No. 3, shut-off. T 5-199.

Test indicated that water present came from formations below 8½", and it was concluded that water above the 8½" was shut off.

Well No. 3, cement deeper. P 5-334.

Approved proposal to cement 8½" not deeper than 3130'.

## SECTION 13.

## Southern Pacific Company, Fuel Oil Department.

Well No. 3, commence drilling. P 5-95.

Proposed depth of water shut-off approved.

Well No. 3, shut-off. T 5-136.

Test showed that 105' of water entered the hole in 22½ hours. It was recommended that the well be drilled ahead into first sand and again bailed to determine source of water.

Well No. 3, production test. T 5-156.

A test of lead-line sample showed well making 5 per cent water. Test of water shut-off satisfactory.

## SECTION 14.

## Shell Company of California.

Well No. 14, reperforate. P 5-86.

Proposal to reperforate oil string approved.

Well No. 14, abandon. P 5-120.

Approved proposal to abandon, recommending that certain casing be left undisturbed.

Shell Co. of California—Continued.

Well No. 16, production test. T 5-35.

Test of a lead-line sample indicated that the work of plugging to exclude bottom water is probably effective.

Well No. 21, shut-off. T 5-31.

Test of water shut-off satisfactory.

Well No. 21, alter casing. P 5-91.

As a result of a fishing job, it was found necessary to drill off the shoe of the water string. It was recommended that the water string be tested after this work.

Well No. 21, shut-off. T 5-63.

Test of water shut-off satisfactory.

Well No. 21, redrill. P 5-145.

Approved proposal to redrill and again test water string for source of water.

Well No. 21, abandon. P 5-287.

Approved proposal to abandon and recommended that 10" be left undisturbed.

Well No. 22, plug bottom. P 5-9.

Approved proposal to plug off bottom water.

Well No. 22, redrill. P 5-71.

Approved proposal to plug well and test 10" water string and to recement same, if necessary.

Well No. 22, shut-off. T 5-117.

Test of water shut-off satisfactory.

Well No. 28, cement deeper. AA-673.

After drilling ahead of 11", which was cemented at 2600', formation and soft cement heaved 700' up into the casing. Approved proposal to prospect ahead and cement 8½" above oil sand.

Well No. 28, shut-off. T 5-43.

Test was not entirely satisfactory, since 1550' of oil was found in the well. It was recommended that well be completed, after which a production test would be made.

Well No. 29, shut-off. T 5-52.

Test of water shut-off satisfactory.

Well No. 30, commence drilling. P 5-17.

Proposed depth of water shut-off approved.

Well No. 30, shut-off. T 5-62.

Test of water shut-off satisfactory.

Well No. 30, deepen. P 5-213.

Proposal to deepen from 2332' to 2385' approved.

Well No. 31, commence drilling. P 5-59.

It was recommended that water be shut off not deeper than 2412' instead of 2440' as proposed.

Well No. 31, shut-off. T 5-90.

10" casing cemented at 2404'. Test of water shut-off satisfactory.

Well No. 31, cement deeper. P 5-146.

A water sand was found below the 10" casing, and proposal to cement 8½" below same was approved.

Well No. 31, shut-off. T 5-108.

Test of water shut-off satisfactory.

Well No. 32, commence drilling. P 5-72.

Proposed depth of water shut-off approved.

Well No. 32, shut-off. T 5-96.

Test of water shut-off satisfactory.

Well No. 33, commence drilling. P 5-81.

Recommended shutting off water at 2370' instead of 2355' as proposed.

Well No. 33, shut-off. T 5-98.

10" cemented at 2376'. Test of water shut-off satisfactory.

Well No. 34, commence drilling. P 5-88.

Proposed depth of water shut-off approved.

## Shell Co. of California—Continued.

Well No. 34, shut-off. T 5-103.

Test of water shut-off satisfactory.

Well No. 35, commence drilling. P 5-87.

Recommended water shut-off at 2120' instead of 2090' as proposed.

Well No. 35, shut-off. T 5-104.

10" cemented at 2100'. Test of water shut-off satisfactory.

Well No. 36, commence drilling. P 5-100.

Recommended that water be shut off at about 1980' instead of 1953' as proposed.

Well No. 36, shut-off. T 5-109.

Test of water shut-off satisfactory.

Well No. 37, commence drilling. P 5-139.

Proposed depth of water shut-off approved.

Well No. 37, shut-off. T 5-131.

Test of water shut-off satisfactory.

Well No. 38, commence drilling. P 5-293.

Proposed depth of water shut-off approved.

Well No. 38, shut-off. P 5-203.

Test of water shut-off satisfactory.

Well No. 39, commence drilling. P 5-306.

Recommended cementing at 2495' instead of 2515' as proposed.

Well No. 44, commence drilling. P 5-227.

Recommended cementing at 2735' instead of 2770' as proposed.

Well No. 44, shut-off. T 5-186.

10" cemented at 2740'. Test of water shut-off satisfactory.

## SECTION 20.

## Standard Oil Company.

Well No. 1, abandon. P 5-166.

Proposal to abandon approved.

Well No. 2, deepen. P 5-8.

Proposal to deepen approved.

Well No. 2, abandon. P 5-175.

Proposal to abandon approved.

Well No. 9, abandon. P 5-24.

Approved proposal to abandon and recommended certain additional plugging.

Well No. 16, redrill. P 5-97.

Approved proposal to clean out and set liner and test for production.

Well No. 16, abandon. P 5-198.

Proposal to abandon approved.

Well No. 18, deepen. P 5-122.

Approved proposal to deepen and test lower formations.

Well No. 18, abandon. P 5-215.

Proposal to abandon approved.

Well No. 22, abandon. P 5-25.

Approved proposal to abandon. The company's attention was called to the requirement that notice must be given before plugging a well.

Well No. 24, commence drilling. P 5-337.

Proposed depth of water shut-off approved.

## SECTION 22.

## Caribou Oil Mining Company.

Well No. 26, commence drilling. P 5-270.

It was recommended that water be shut off at 1090' instead of 1060' as proposed.

Well No. 26, shut-off. T 5-191.

10" cemented at 1091'. Test of water shut-off satisfactory.

## Standard Oil Company (Peerless).

Well No. 15, redrill and deepen. P 5-78.

Proposal to redrill and deepen was approved and certain additional plugging and testing recommended.

Well No. 15, shut-off. T 5-95.

8½" cemented at 1042' to shut off top water. Test of water shut-off satisfactory.

Well No. 15, plug bottom. P 5-170.

Approved proposal to plug to shut out bottom water. This work was done prior to filing notice and same was called to the attention of the company.

Well No. 15, shut-off. T 5-126.

The test indicated that the bottom plug was effective, and the water present coming from the oil sands.

Well No. 20, redrill. P 5-259.

Approved proposal to recement 10" casing and if not successful to cement 8½" below 10".

Well No. 20, shut-off. T 5-174.

8½" cemented at 1292'. Test of water shut-off satisfactory.

Well No. 23, plug bottom. P 5-26.

Approved proposal to plug off bottom water.

Well No. 24, commence drilling. P 5-15.

Recommended cementing not deeper than 1135' instead of 1280' as proposed.

Well No. 24, shut-off. T 5-73.

The 10" cemented at 1150' was a failure; 8½" casing was cemented at 1170' and test of same was satisfactory.

Well No. 25, commence drilling. P 5-16.

Recommended cementing not deeper than 1145' instead of 1270' as proposed.

Well No. 25, shut-off. T 5-84.

10" cemented at 1143'. Test of water shut-off satisfactory.

Well No. 26, commence drilling. P 5-112.

Recommended cementing at 1078' instead of 1030' as proposed.

Well No. 26, shut-off. T 5-116.

10" casing cemented at 1014'. Test showed that 110' of water and 40' of oil entered the hole. Test of water shut-off not satisfactory, and it was recommended that the 8½" be cemented at about 1078' as previously recommended.

Well No. 26, shut-off. T 5-129.

8½" casing cemented at 1058'. Test of water shut-off satisfactory.

## Record Oil Co.

Well No. 12, report of work. P 5-58.

Certain work done on this well was not in accordance with recommendations in report AA-491 of February 24, 1917, and an oil sand was left unprotected. This report stated that further recommendations would be made after receipt of notices from the company.

Well No. 12, abandon. P 5-63.

The proposal to abandon was approved and certain shooting and plugging recommended.

## Good Luck Oil Co.

Well No. 7, commenced drilling. P 5-105.

Proposed depth of water shut-off approved.

Well No. 7, shut-off. T 5-102.

Test of water shut-off satisfactory.

Well No. 8, commenced drilling. P 5-280.

Recommended that water be shut off at about 1540' instead of 1530' as proposed.

## Universal Oil Co.

Well No. 2, abandon. P 5-278.

Approved proposal to abandon.

Well No. 2, redrill. P 5-320.

During the work of abandonment, the well showed considerable oil and the proposal to shut off water and produce it was approved.

## Universal Oil Co.—Continued.

Well No. 3, redrill. P 5-201.

Proposal to redrill and shut off top water approved.

Well No. 3, plug bottom. P 5-335.

Approved proposal to plug off bottom water.

Well No. 8, abandon. P 5-161.

The proposal to abandon was approved and certain plugging recommended.

Well No. 8, test of plug. T 5-121.

This test was for depth and hardness of cement plug, which were satisfactory. Company's attention was called to the fact that certain requirements in abandonment had not been met, and future development may indicate the necessity of additional work at this well.

Well No. 8, test of plug. T 5-122.

Test of location and hardness of cement plug satisfactory.

Well No. 9, abandon. P 5-41.

After certain plugging and shooting the abandonment was approved.

Well No. 10, commence drilling. P 5-106.

Depth of water shut-off recommended at 1280' instead of 1230' as proposed.

Well No. 10, shut-off. T 5-118.

10" casing cemented at 1295'. Test of water shut-off satisfactory.

Well No. 11, commence drilling. P 5-131.

Proposed depth of water shut-off approved.

Well No. 11, shut-off. T 5-151.

Test of water shut-off satisfactory.

Well No. 12, commence drilling. P 5-211.

Recommended depth of water shut-off at about 1345' instead of 1325' as proposed.

Well No. 12, shut-off. T 5-178.

8½" cemented at 1378'. Test of water shut-off satisfactory.

Well No. 13, commence drilling. P 5-277.

This well was resurveyed by this department and the depth of water shut-off recommended not deeper than 1490' instead of 1370' as proposed.

## SECTION 26.

## Shell Co. of California.

Well No. 2, redrill. AA-672.

The company proposed to redrill and cement the water string below the upper oil sands, 125' deeper than it was originally cemented, or at 1865'. It was recommended that the 8½" be cemented not deeper than 1950', to be at the same relative depth as neighboring wells.

Well No. 2, supplementary redrill. P 5-109.

After considerable correspondence relative to the above recommendation, the company filed a supplementary proposal to mud up the upper oil sands and cement the 8½" at about 1990'. Proposal approved.

Well No. 2, deepen. P 5-163.

Approved proposal to drill 25' ahead of new water string and make pumping tests of water shut-off.

Well No. 2, shut-off. T 5-114.

It was not possible to make a satisfactory pumping test, and a series of bailing tests reported by the company warranted passing the well for further drilling.

Well No. 25, shut-off. T 5-21.

Test of water shut-off satisfactory.

Well No. 26, shut-off. T 5-26.

Test of water shut-off satisfactory.

Well No. 28, commence drilling. P 5-140.

Proposed depth of water shut-off approved.

Well No. 28, shut-off. T 5-139.

Test of water shut-off satisfactory.

## Shell Co. of California—Continued.

Well No. 29, commence drilling. P 5-138.

Approved proposal to shut off water below upper oil sands after thoroughly mudding and cementing.

Well No. 29, recement. P 5-203.

After cementing the 10" casing, it was found that a joint was split. Approved proposal to perforate the last two joints of 10" and cement 8½" above the first oil sand under pressure.

Well No. 29, deepen. P 5-236.

After drilling ahead of the 8½" water string, gas blew all water out of casing. Bailer was run to bottom and came out empty. Approved proposal to complete well and make pumping test.

Well No. 30, commence drilling. P 5-173.

Approved proposal to shut off water below upper oil sands after thoroughly mudding and cementing.

Well No. 30, shut-off. T 5-137.

Test of water shut-off satisfactory.

Well No. 31, commence drilling. P 5-188.

Approved proposal to shut off water below upper oil sands after thoroughly mudding and cementing.

Well No. 30, shut-off. T 5-188.

Test of water shut-off satisfactory.

## SECTION 27.

## Shell Co. of California.

Well No. 62, abandon. AA-674.

Proposal to abandon approved.

Well No. 79, shut-off. T 5-29.

Test of water shut-off satisfactory.

Well No. 83, redrill. P 5-254.

Approved proposal to redrill and recommended that upper oil sand be thoroughly mudded before cementing below intermediate water.

Well No. 84, shut-off. T 5-18.

Test of water shut-off satisfactory.

Well No. 85, shut-off. T 5-24.

Test of water shut-off satisfactory.

Well No. 85, cement deeper. P 5-21.

Approved proposal to mud upper oil sands and cement below intermediate water.

Well No. 85, shut-off. T 5-48.

Test indicated that water was prevented from entering the oil sands below the water string.

Well No. 86, commence drilling. P 5-4.

Proposed depth of water shut-off approved.

Well No. 86, shut-off. T 5-45.

Test of water shut-off satisfactory.

Well No. 87, commence drilling. P 5-6.

Proposed depth of water shut-off approved.

Well No. 87, shut-off. T 5-44.

Test of water shut-off satisfactory.

Well No. 88, commence drilling. P 5-50.

Proposed depth of water shut-off approved.

Well No. 88, shut-off. T 5-65.

Test of water shut-off satisfactory.

Well No. 89, commence drilling. P 5-51.

Proposed depth of water shut-off approved.

Well No. 89, shut-off. T 5-64.

Test of water shut-off satisfactory. This test reported by the company.

Shell Co. of California—Continued.

Well No. 90, commence drilling. P 5-85.

The Shell Company proposed to drill this well as an experiment and located it 150' north of No. 78 in order to note the effect on the upper oil sands from which No. 78 is producing. It was proposed to drill the well with rotary tools, to mud up the upper oil sands and intermediate water and cement 10" casing below the intermediate water with sufficient cement to go above the upper oil sands outside the casing. Proposal approved.

Well No. 90, shut-off. T 5-78.

This test showed that the 10" was cemented above a water sand and that water above the shoe was shut off.

Well No. 90, cement deeper. P 5-118.

Approved proposal to cement 8 $\frac{1}{4}$ " below water sand.

Well No. 90, shut-off. T 5-86.

Test of water shut-off satisfactory.

Well No. 91, commence drilling. P 5-132.

Approved proposal to mud upper oil sands and cement below intermediate water.

Well No. 91, shut-off. T 5-119.

Test of water shut-off satisfactory.

Well No. 92, commence drilling. P 5-172.

Approved proposal to mud upper oil sands and cement below intermediate water.

Well No. 92, shut-off. T 5-143.

Test of water shut-off satisfactory.

Well No. 93, commence drilling. P 5-179.

Approved proposal to mud upper oil sands and cement below intermediate water.

Well No. 93, commence drilling. P 5-196.

Location changed. Approved proposal to mud upper oil sands and cement below intermediate water.

Well No. 93, shut-off. T 5-150.

Test of water shut-off satisfactory.

Well No. 94, commence drilling. P 5-294.

Proposed method of drilling similar to Well No. 90. Notice was received after well was cemented and drilling was started subsequent to letter from State Oil and Gas Supervisor to the company recommending discontinuance of this method pending more definite results of this experiment. Approval withheld until question decided.

Well No. 94, shut-off. T 5-189.

Test of water shut-off satisfactory.

Well No. 95, commence drilling. P 5-206.

Approved proposal to mud upper oil sands and cement below intermediate water.

Well No. 95, shut-off. T 5-158.

Test of water shut-off satisfactory.

Well No. 96, commence drilling. P 5-250.

Approved proposal to mud upper oil sands and cement below intermediate water.

Well No. 96, shut-off. T 5-176.

Test of water shut-off satisfactory.

Well No. 97, commence drilling. P 5-219.

Approved proposal to mud upper oil sands and cement below intermediate water.

Well No. 97, shut-off. T 5-167.

Test of water shut-off satisfactory.

Well No. 98, commence drilling. P 5-295.

Proposal similar to Well No. 90. Approval withheld until question of discontinuance of this method is decided.

Well No. 98, shut-off. T 5-196.

Test of water shut-off satisfactory.

Well No. 99, commence drilling. P 5-312.

Proposal similar to Well No. 90. Approval withheld until question of discontinuance of this method is decided.

Shell Co. of California—Continued.

Well No. 100, commence drilling. P 5-296.

Proposal similar to Well No. 90. Approval withheld until question of discontinuance of this method is decided.

Well No. 100, shut-off. T 5-195.

Test of water shut-off satisfactory.

Well No. 101, commence drilling. P 5-297.

Proposal similar to Well No. 90. Approval withheld until question of discontinuance of this method is decided.

Well No. 102, commence drilling. P 5-298.

Proposal similar to Well No. 90. Approval withheld until question of discontinuance of this method is decided.

Well No. 103, commence drilling. P 5-329.

Proposal similar to Well No. 90. Approval withheld until question of discontinuance of this method is decided.

Well No. 106, commence drilling. P 5-302.

Proposal similar to Well No. 90. Approval withheld until question of discontinuance of this method is decided.

Well No. 107, commence drilling. P 5-311.

Proposal similar to Well No. 90. Approval withheld until question of discontinuance of this method is decided.

#### SECTION 28.

Standard Oil Company.

Well No. 105, shut-off. T 5-16.

Test of 12½" casing satisfactory.

Well No. 105, shut-off. T 5-57.

Test of 10" casing satisfactory.

Well No. 105, shut-off. T 5-101.

Test of 8½" casing satisfactory.

Well No. 105, abandon. P 5-227.

Approved proposal to abandon.

Well No. 105, test of plug. T 5-146.

Location of plug and hardness of cement satisfactory.

Well No. 105, test of plug. T 5-149.

Location of plug and hardness of cement satisfactory.

Well No. 106, commence drilling. P 5-328.

Recommended point of water shut-off not deeper than 2890' instead of 3080' as proposed.

#### SECTION 29.

Shell Company of California.

Well No. 6, production test. T 5-8.

A lead-line sample showed considerable water, but a continuation of pumping was recommended.

Well No. 7, commence drilling. P 5-14.

Recommended that 10" casing be cemented not deeper than 2640', to be above the top oil sand, which was estimated at 2650'. The company proposed to cement at 2675' and estimated top of oil sands at 2695'.

Well No. 7, shut-off. T 5-68.

After considerable correspondence and discussion relative to location of top oil sand, the company proceeded to cement the 10" at 2696'. This test showed that top water was not shut off, and the depth of cementing was disapproved.

Well No. 7, cement deeper. P 5-96.

Proposal to drill ahead and cement 8½" above first oil sand encountered disapproved.

Well No. 7, oral proposal to test and recement. P 5-99.

After discussion the company agreed to plug up into 10" casing and perforate at 2655' to test for oil and attempt to force cement out through perforations.

## Shell Co. of California—Continued.

Well No. 7, test of formation. T 5-80.

The 10" casing was ripped at 2655' and considerable oil was shown in the bailing test, proving the existence of an oil sand at or near the point of ripping. It was recommended that the company proceed to recement.

Well No. 7, shut-off. T 5-105.

Test showed that attempt at recementing failed. Recommended shooting and drilling up 10" and cement 8½" above 2650' to test out oil sand previously shut off. Well No. 7, cement deeper. P 5-181.

Approved conditionally the proposal to mud up oil sands and cement 8½" 78' below top of first oil sand.

Well No. 7, shut-off. T 5-134.

Test showed that water was shut off from above 2733'.

## SECTION 31.

## Commercial Petroleum Company.

Well No. 9, redrill. P 5-101.

Approved proposal to redrill.

Well No. 11, abandon. P 5-276.

Proposal approved, specifying additional shooting and plugging.

## Maine State Oil Company.

Well No. 14, commence drilling. P 5-147.

Recommended point of water shut-off not deeper than 1080' instead of 1300' as proposed.

Well No. 14, supplementary commence drilling. P 5-150.

Approved proposal to cement 12½" at 1040' and 10" at 1300'. It was later proposed orally to mud upper oil sands and cement 10" only at 1300'. Proposal approved.

Well No. 14, shut-off. T 5-147.

Test showed top water shut off, but method of drilling was disapproved, since it was believed that not sufficient mudding was done to protect top oil sands. Further protective work at this well is recommended in case damage to sands is shown.

Well No. 14, commence drilling. P 5-304.

Proposal to cement at 1250' disapproved. Requested further notice stating what protection would be given to oil sands below 1050'.

Well No. 15, supplementary commence drilling. P 5-319.

Approved proposal to mud upper oil sands and cement at 1250'.

## W. M. &amp; M. Oil Company.

Well No. 4, abandon. P 5-231.

Proposal approved, specifying additional plugging.

Well No. 4, test of plug. T 5-179.

Test for location and hardness of cement satisfactory.

Well No. 5, abandon. P 5-176.

Proposal approved, specifying depths of shooting and plugging.

Well No. 5, test of plug. T 5-152.

Location and hardness of cement satisfactory.

## SECTION 32.

## American Petroleum Company.

Well No. 54, commence drilling. P 5-33.

Recommended depth of water shut-off at 2020' instead of 2120' as proposed.

Well No. 54, shut off. T 5-197.

Cemented 10" at 2014'. Test of water shut-off satisfactory.

Well No. 55, commence drilling. P 5-34.

Recommended depth of water shut-off at 1985' instead of 2040' as proposed.

Well No. 55, shut off. T 5-76.

Cemented 10" at 1985'. Test of water shut-off satisfactory.

## American Petroleum Co. - Continued.

Well No. 56, commence drilling. P 5-35.

Recommended depth of water shut-off at 2068' instead of 2100' as proposed.

Well No. 56, shut off. T 5-111.

Cemented 10" at 2067'. Test of water shut-off satisfactory.

Well No. 57, commence drilling. P 5-36.

Recommended depth of water shut-off at 2162' instead of 2190' as proposed.

Well No. 57, shut off. T 5-125.

Cemented 10" at 2161'. Test of water shut-off satisfactory.

Well No. 58, commence drilling. P 5-37.

Proposed depth of water shut-off approved.

Well No. 58, shut off. T 5-148.

Test of water shut-off satisfactory.

Well No. 58, redrill. P 5-267.

Approved proposal to test water string.

Well No. 58, shut off. T 5-219.

Test of 8 1/2" was inconclusive. Approved proposal to complete well and make production test.

Well No. 59, commence drilling. P 5-38.

Proposed depth of water shut-off approved.

Well No. 59, shut off. T 5-181.

Test of water shut-off satisfactory.

Well No. 60, commence drilling. P 5-266.

Recommended depth of water shut-off at 2420' instead of 2460' as proposed.

Well No. 60, supplementary commence drilling. P 5-330.

According to corrected location, recommended water shut-off at 2448'.

## Call Oil Company.

Well No. 3, abandon. P 5-303.

Approved proposal, specifying depths of shooting and plugging.

Well No. 4, commence drilling. P 5-216.

Proposed depth of water shut-off approved.

Well No. 4, shut off. T 5-224.

Well passed for further drilling and production test, on account of inconclusive bailing test.

Well No. 5, commence drilling. P 5-339.

Proposed depth of water shut-off approved.

## Pantheon Oil Company (by Associated Oil Company).

Well No. 1, shut off. T 5-46.

Test of water shut-off satisfactory.

Well No. 2, commence drilling. P 5-156.

Proposed depth of water shut-off approved.

Well No. 2, shut off. T 5-133.

Test of water shut-off satisfactory.

Well No. 22, shut off. T 5-82.

Test of water shut-off satisfactory.

Well No. 23, commence drilling. P 5-158.

Proposed depth of water shut-off approved.

Well No. 23, shut off. T 5-212.

Test of water shut-off satisfactory.

Well No. 31, shut off. T 5-106.

Test of water shut-off satisfactory.

Well No. 32, shut off. T 5-67.

Test of water shut-off satisfactory.

Well No. 33, shut off. T 5-27.

Test of water shut-off satisfactory.

Well No. 41, commence drilling. P 5-90.

Recommended depth of water shut-off 2297' instead of 2220' as proposed.

## Pantheon Oil Co.—Continued.

Well No. 41, supplementary commence drilling. P 5-93.

Location of well corrected. Proposed depth of water shut-off approved.

Well No. 41, supplementary commence drilling. P 5-162.

The 10" cementing job was unsuccessful. Approved proposal to cement in an 8 $\frac{1}{4}$ " liner.

Well No. 41, shut off. T 5-123.

Test of water shut-off satisfactory.

Well No. 41, redrill. T 5-316.

Approved proposal to redrill.

Well No. 42, commence drilling. P 5-157.

Proposed depth of shut-off approved.

Well No. 42, supplementary commence drilling. P 5-226.

Approved proposal to move derrick and start new hole.

Well No. 42, shut off. T 5-198.

Test of water shut-off satisfactory.

Well No. 43, commence drilling. P 5-125.

Proposed depth of water shut-off approved.

Well No. 43, shut off. T 5-185.

Test of water shut-off satisfactory.

Well No. 51, redrill. P 5-94.

Proposal to recement 10" approved.

Well No. 51, recement. P 5-128.

Approved proposal to cement in 8 $\frac{1}{4}$ " liner.

Well No. 51, shut off. T 5-92.

Test of water shut-off satisfactory.

Well No. 51, redrill. P 5-217.

Approved proposal to redrill and test water string to locate source of water.

Well No. 51, alter casing. P 5-224.

Recommended that well be plugged in the bottom, since the water analysis indicated that to be the source of water.

Well No. 51, plug bottom. P 5-315.

Proposed depth of plugging approved, but recommended the use of cement instead of lead wool.

Well No. 52, commence drilling. P 5-194.

Proposed depth of water shut-off approved.

Well No. 52, supplementary commence drilling. P 5-301.

10" casing froze above bottom. Approved proposal to cement 8 $\frac{1}{4}$ " casing.

Well No. 52, shut off. T 5-213.

Test of water shut-off satisfactory.

Well No. 53, commence drilling. P 5-195.

Proposed depth of water shut-off approved.

Well No. 53, shut off. T 5-225.

Test of water shut-off satisfactory.

## SECTION 33.

## Southern Pacific Company, Fuel Oil Department.

Well No. 38, commence drilling. P 5-245.

Recommended depth of water shut-off 3130' instead of 3153' as proposed.

Well No. 239 (new), commence drilling. P 5-361.

The old hole was lost and the derrick moved to a new location. Proposed depth of water shut-off approved.

## SECTION 34.

## Shell Company of California.

Well No. 30, redrill. P 5-237.

Proposal to redrill approved.

Well No. 35, shut off. T 5-59.

Test of water shut-off satisfactory.

## Shell Co. of California - Continued.

Well No. 36, shut off. T 5-54.

Test of water shut-off satisfactory.

Well No. 37, commence drilling. P 5-197.

Proposed depth of water shut-off approved.

Well No. 37, shut off. T 5-153.

Test of water shut-off satisfactory.

Well No. 38, commence drilling. P 5-207.

Proposed depth of water shut-off approved.

Well No. 38, shut off. T 5-166.

Test of water shut-off satisfactory.

Well No. 39, commence drilling. P 5-238.

Proposed depth of water shut-off approved.

Well No. 39, shut off. T 5-187.

Test of water shut-off satisfactory.

Well No. 40, commence drilling. P 5-251.

Proposed depth of water shut-off approved.

Well No. 41, commence drilling. P 5-218.

Proposed depth of water shut-off approved.

Well No. 41, commence drilling. T 5-171.

Test of water shut-off satisfactory.

Well No. 42, commence drilling. P 5-257.

Proposed depth of water shut-off approved.

Well No. 43, commence drilling. P 5-233.

Proposed depth of water shut-off approved.

## SECTION 35.

## Southern Pacific Company, Fuel Oil Department.

Well No. 12, redrill. P 5-253.

Approved proposal to redrill, recommending plugging side-tracked casing.

Well No. 26, shut off. T 5-7.

Well passed for further drilling and production test.

Well No. 26, production test. T 5-38.

Lead-line sample showed trace of water. Test of water shut-off satisfactory.

Well No. 27, commence drilling. P 5-164.

Proposed depth of water shut-off approved.

Well No. 27, shut off. T 5-160.

Test of water shut-off satisfactory.

Well No. 33, shut off. T 5-107.

On account of large amount of fluid in hole, well was passed for further drilling and production test.

Well No. 33, production test. T 5-157.

Test of lead-line sample showed 4.4% free water and 2.4% emulsion. Test satisfactory.

Well No. 37, shut off. T 5-37.

Test of water shut-off satisfactory.

Well No. 38, shut off. T 5-32.

Test of water shut-off satisfactory.

Well No. 38, redrill. P 5-271.

Approved proposal to cement 8" casing below doubtful sand, which may be the source of water.

Well No. 38, shut off. T 5-188.

Test of water shut-off satisfactory.

Well No. 41, shut off. T 5-74.

Test of water shut-off satisfactory.

Well No. 44, shut off. T 5-49.

Well passed for further drilling.

## Southern Pacific Co., Fuel Oil Department -Continued.

Well No. 45, shut off. T 5-53.

Test of water shut-off satisfactory.

Well No. 46, commence drilling. P 5-22.

Proposed depth of water shut-off approved.

Well No. 46, cement deeper. P 5-177.

11" cementing job failed. Approved proposal to cement in 8 $\frac{1}{4}$ " liner.

Well No. 46, recement. P 5-243.

Cementing job failed on 8 $\frac{1}{4}$ " liner. Approved proposal to pull 8 $\frac{1}{4}$ " liner and cement full string of 8 $\frac{1}{4}$ " casing.

Well No. 46, shut off. T 5-161.

Test of water shut-off satisfactory.

Well No. 50, commence drilling. P 5-258.

Proposed depth of water shut-off approved.

Well No. 71, commence drilling. P 5-45.

Proposed depth of water shut-off approved.

Well No. 71, shut off. T 5-70.

Test of water shut-off satisfactory.

Well No. 72, shut off. T 5-71.

Test of water shut-off satisfactory.

Well No. 73, commence drilling. P 5-155.

Recommended water shut-off at 2438' instead of 2458' as proposed.

Well No. 73, shut off. T 5-135.

11" casing cemented at 2448'. Test of water shut-off satisfactory.

Well No. 74, commence drilling. P 5-241.

Proposed depth of water shut-off approved.

Well No. 74, shut off. T 5-190.

On account of large amount of fluid in hole, the bailing test was inconclusive and well was passed for further drilling.

Well No. 76, commence drilling. P 5-191.

Proposed depth of water shut-off approved.

Well No. 76, shut off. T 5-170.

10" cementing job failed. Approved proposal to cement in 8 $\frac{1}{4}$ " liner.

Well No. 76, shut off. T 5-175.

Test of water shut-off satisfactory.

Well No. 77, commence drilling. P 5-240.

Proposed depth of water shut-off approved.

Well No. 77, shut off. T 5-194.

Test showed that 11" cementing job was a failure. Approved proposal to drill ahead about 20' and cement 8 $\frac{1}{4}$ " casing.

Well No. 77, shut off. T 5-204.

Test of water shut-off satisfactory.

Well No. 78, commence drilling. P 5-204.

Proposed depth of water shut-off approved.

Well No. 78, redrill. P 5-282.

11" casing cemented at 2619' failed to shut off water. Approved proposal to shoot 11" casing, redrill, and cement 8 $\frac{1}{4}$ " at about 2599'.

Well No. 78. Shut off. T 5-173.

Test showed that water was not shut off, due to split in shoe joint. It was recommended that the company recement 8 $\frac{1}{4}$ " casing at about 2600'.

Well No. 78, shut off. T 5-184.

Test inconclusive on account of bridge 470' above shoe. Recommended putting in oil string to prevent heaving sand, and retesting.

Well No. 90, commence drilling. P 5-323.

Recommended cementing at 2670' instead of 2690', as proposed.

Well No. 92, commence drilling. P 5-324.

Recommended cementing at 2725' instead of 2745', as proposed.

Well No. 93, commence drilling. P 5-325.

Recommended cementing at 2770' instead of 2785', as proposed.

## SECTION 36.

## Shell Company of California.

Well No. 1, alter casing. P 5-12.

Approved proposal to reperforate oil string.

Well No. 2, production test. T 5-11.

Lead-line sample showed 22% water. Recommended that well continue to pump.

Well No. 2, plug bottom. P 5-89.

Approved proposal to plug off bottom water.

Well No. 3, redrill. P 5-70.

Approved proposal to redrill oil string.

Well No. 3, shut off. T 5-69.

During redrilling it was necessary to drill off a portion of the water string.

This test indicated that water was still shut off.

## Standard Oil Company.

Well No. 1, plug bottom. P 5-82.

Approved location of plugs to shut off bottom water.

Well No. 1, supplementary redrill. P 5-115.

Approved proposal to redrill and shut off top water.

Well No. 7, commence drilling. P 5-144.

Proposed depth of water shut-off approved.

T. 20 S., R. 14 E., M.D.B. & M.

## SECTION 1.

## Penn Coalinga Petroleum Company.

Well No. 3, redrill. P 5-1.

Approved proposal to redrill oil string.

Well No. 6, redrill. P 5-279.

Approved proposal to redrill oil string.

## Zier Oil Company.

Well No. 19, commence drilling. P 5-57.

Recommended water shut-off at 310' instead of 250' as proposed.

Well No. 19, shut off. T 5-56.

Test of water shut-off satisfactory.

Well No. 20, commence drilling. P 5-126.

Proposed depth of water shut-off approved.

Well No. 20, shut off. T 5-93.

Test of water shut-off satisfactory.

Well No. 21, commence drilling. P 5-154.

Proposed depth of water shut-off approved.

## SECTION 12.

## Coalinga Star Oil Company.

Well No. 1, redrill. P 5-212.

Approved proposal to redrill oil string.

Well No. 2, redrill. P 5-261.

Approved proposal to redrill oil string.

Well No. 9, redrill. P 5-317.

Approved proposal to redrill oil string.

Well No. 11, production test. T 5-5.

Test of lead-line sample showed 1% emulsion. Test of water shut-off satisfactory.

Well No. 11, redrill. P 5-183.

Approved proposal to redrill oil string.

## Homestead Development Company.

Well No. B1, redrill. P 5-46.

Approved proposal to redrill oil string.

Well No. B8, redrill. P 5-283.

Approved proposal to mud upper oil sand and cement below same.

## Homestead Development Co.—Continued.

Well No. B10, shut off. T 5-42.

Test of water shut-off satisfactory.

## Pilot Oil Company.

Well No. 4, redrill. P 5-160.

Approved proposal to redrill oil string.

Well No. 6, redrill. P 5-28.

Approved proposal to redrill and test for source of water.

Well No. 6, alter casing. P 5-68.

Approved proposal to set packer on oil string.

## Seneca Oil Company.

Well No. 6, supplementary abandon. P 5-67.

Proposed change in method of abandonment approved.

Well No. 6, test of plug. T 5-58.

Location and hardness of cement plug approved.

Well No. 8, commence drilling. P 5-113.

Recommended cementing not deeper than 467' instead of 490' as proposed.

Well No. 8, shut off. T 5-128.

10" cemented at 451'. Test of water shut-off satisfactory.

## Associated Oil Company.

Well No. 5, commence drilling. P 5-239.

Proposed depth of water shut-off approved.

Well No. 5, supplementary commence drilling. P 5-289.

Approved proposal to mud upper tar sands and cement 10" casing below same.

Well No. 5, shut off. T 5-192.

Test of water shut-off satisfactory.

## Spinks Crude Oil Company.

Well No. 2A, redrill. P 5-47.

Approved proposal to redrill oil string.

Well No. 8, shut off. T 5-50.

Test of water shut-off satisfactory.

Well No. 8, redrill. P 5-322.

Approved proposal to redrill oil string.

## Ward Oil Company.

Well No. 7, alter casing. P 5-338.

Approved proposal to repair oil string.

## SECTION 13.

## Southern Pacific Company, Fuel Oil Department.

Well No. 12, alter casing. P 5-74.

Approved proposal to set packer on oil string.

Well No. 18, production test. A-359.

Test of lead-line sample warranted approval of water condition.

## Union Oil Company of California.

Well No. 4, alter casing. P 5-248.

Approved proposal to set packer on oil string.

Well No. 9, alter casing. P 5-110.

Approved proposal to reset packer.

Well No. 16, production test. T 5-4.

Test of lead-line sample warranted approval of water condition.

Well No. 17, alter casing. P 5-65.

Approved proposal to set packer on oil string.

Well No. 17, alter casing. P 5-193.

Approved proposal to reset packer.

Well No. 17, alter casing. P 5-210.

Approved proposal to reset packer.

## SECTION 14.

## Strong Oil Company.

Well No. 2, redrill. P 5-27.

Approved proposal to redrill and locate source of water.

Well No. 2, shut off. T 5-85.

Test of water shut-off satisfactory.

## SECTION 23.

## St. Paul Consolidated Oil Company.

Well No. 2, test of water shut-off. P 5-5.

Certain work was done without notice or approval of this department. Approved proposal to pull 7 $\frac{5}{8}$ " casing and pump well for thirty days for test of water shut-off, as well could not be tested by bailing.

Well No. 7A, redrill. P 5-10.

Approved proposal to redrill and shut off water, and specifying certain depths of plugging.

Well No. 7A, alter casing. P 5-200.

Approved proposal to set packer on oil string.

Well No. 7A, abandon. P 5-220.

Approved proposal to abandon, specifying depths of shooting and plugging.

Well No. 7A, supplementary abandon. P 5-249.

Additional information was submitted which warranted change of previous specifications for abandonment.

Well No. 7A, redrill. P 5-313.

Approved proposal to redrill, shutting off water below top oil sand by using sufficient cement to come up between casings and testing same by perforating.

## SECTION 24.

## Claremont Oil Company.

Well No. 1, plug casing. P 5-40.

Approved proposal to pull out oil string and plug between water string and top oil sand.

Well No. 2, plug casing. P 5-39.

Approved proposal to pull oil string and plug between top oil sand and shoe of water string.

Well No. 2, redrill. P 5-53.

Approved proposal to shut off top water with 6 $\frac{5}{8}$ " casing and redrill.

Well No. 5, redrill. P 5-104.

Approved proposal to redrill oil string and set packer.

Well No. 6, alter casing. P 5-19.

Approved proposal to reset packer.

Well No. 8, redrill. P 5-52.

Approved proposal to again plug off bottom water.

Well No. 8, deepen. P 5-107.

Approved proposal to mud oil sands, cement below bottom water, and prospect for deeper oil sands.

Well No. 8, deepen. P 5-288.

Test of 8 $\frac{1}{2}$ " casing cemented below water sand was inconclusive. Additional water sands were also encountered. Proposal to prospect ahead and locate oil sand before cementing 6 $\frac{5}{8}$ " casing approved.

Well No. 8. P 5-305.

Approved proposal to mud lower sands under pressure and cement 6 $\frac{5}{8}$ " casing.

Well No. 9, alter casing. P 5-20.

Approved proposal to reset packer.

Well No. 9, alter casing. P 5-265.

Approved proposal to reset packer.

Well No. 19, alter casing. P 5-268.

Approved proposal to set packer on oil string.

## Claremont Oil Co.—Continued.

Well No. 20, shut off. T 5-60.

Test of water shut-off satisfactory.

## Inca Oil Company.

Well No. 8, alter casing. P 5-102.

Approved proposal to set packer on oil string.

Well No. 33, alter casing. P 5-327.

Approved proposal to set packer on oil string.

## Premier Oil Company.

Well No. 1, redrill. P 5-29.

Approved proposal to plug bottom and test for bottom water.

Well No. 1, redrill. P 5-66.

Approved proposal to continue plugging and testing.

Well No. 1, shut off. T 5-91.

6½" casing cemented to shut off top water. Test of water shut-off satisfactory.

Well No. 6, redrill. P 5-44.

Approved proposal to redrill oil string.

Well No. 18, alter casing. P 5-285.

Approved proposal to set packer in oil string.

## Salvia Oil Company.

Well No. 14, production test. T 5-51.

Test of lead-line sample warranted approval of water condition.

## Traders Oil Company.

Well No. 19, redrill. P 5-178.

Approved proposal to redrill and test for top water.

Well No. 19, shut off. T 5-120.

Test indicated that 10" water string was tight.

Well No. 19, supplementary redrill. P 5-199.

Approved proposal to test oil sands and locate source of water.

Well No. 19, shut off. T 5-130.

Test indicated that source of water was probably sand. Logged 749-757'.

Well No. 20, redrill. P 5-234.

Approved proposal to redrill and test water string.

Well No. 20, shut off. T 5-182.

Test proved water string to be tight. Approved proposal to bridge hole and test oil sands.

Well No. 25, production test. T 5-34.

Test of lead-line sample indicated that packer shut off top water.

## SECTION 25.

## Southern Pacific Company, Fuel Oil Department.

Well No. 31, redrill. P 5-75.

Approved proposal to set packer on oil string.

Well No. 35, abandon. P 5-275.

Approved proposal to abandon, recommending depths of shooting and plugging.

Well No. 35, test of plugs. T 5-202.

Location and hardness of cement satisfactory.

Well No. 39, alter casing. P 5-92.

Approved proposal to set packer on oil string.

Well No. 41, alter casing. P 5-151.

Approved proposal to set packer on oil string.

Well No. 45, alter casing. P 5-255.

Approved proposal to set packer on oil string.

## SECTION 26.

Coalinga Homestake Oil Company:

Well No. 1A, redrill. P 5-260.

Approved proposal to put in oil string.

Well No. 2A, redrill. P 5-127.

Approved proposal to plug and test deep sands.

Well No. 2A, redrill. P 5-141.

Approved proposal to plug and perforate oil string for production.

Well No. 2A, test of plug. T 5-94.

Location and hardness of cement satisfactory.

Well No. 2A, shut off. T 5-97.

Test of bottom water shut-off satisfactory.

Augustine and Butz Oil Company.

Well No. 6, shut off. T 5-17.

Test indicated that 8½" casing shut off top water.

Netherlands Oil Company.

Well No. 3, production test. T 5-6.

Test of lead-line sample warranted the continuation of pumping for further test.

Ozark Oil Company.

Well No. 2, redrill. P 5-153.

Approved proposal to redrill oil string.

Well No. 5, redrill. P 5-7.

Approved proposal to bridge and test water string.

Well No. 5, redrill. P 5-11.

Approved proposal to set packer on oil string.

## SECTION 34.

Kyle & Lewis.

Progressive Oil Company Well No. 1, abandon. P 5-333.

Approved proposal to abandon without plugging.

T. 20 S., R. 15 E., M.D.B. & M.

## SECTION 1.

Southern Pacific Company, Fuel Oil Department.

Well No. 4, shut off. T 5-40.

Test of water shut-off satisfactory.

Well No. 16, commence drilling. P 5-83.

Proposed depth of water shut-off approved after depth to "red rock" was reported.

Well No. 16, cement deeper. P 5-169.

8½" casing failed to shut off water. Approved proposal to cement in 6½" liner.

Well No. 46, production test. T 5-14.

Test of lead-line sample showed trace of water. Test of water shut-off satisfactory.

Well No. 47, shut off. T 5-41.

Test of water shut-off satisfactory.

Well No. 138, shut off. T 5-23.

Test of water shut-off satisfactory.

Well No. 138, redrill. P 5-114.

Approved proposal to redrill and shut off top water.

Well No. 138, shut off. T 5-140.

Test of water shut-off satisfactory.

## SECTION 2.

Shell Company of California.

Well No. 20, redrill. P 5-124.

Approved proposal to plug bottom and test for production.

## Shell Co. of California—Continued.

Well No. 20, abandon. P 5-182.

Approved depth of shooting and plugging.

Well No. 24, alter casing. P 5-103.

Approved proposal to put in 4½" liner.

Well No. 26, alter casing. P 5-18.

Approved proposal to reperfurate oil string.

Well No. 27, alter casing. P 5-43.

Approved proposal to reperfurate oil string.

Well No. 28, alter casing. P 5-49.

Approved proposal to reperfurate oil string.

Well No. 29, alter casing. P 5-69.

Approved proposal to do additional perforating.

Well No. 33, alter casing. P 5-13.

Approved proposal to reperfurate oil string.

Well No. 37, shut off. T 5-169.

Test of water shut-off satisfactory.

Well No. 38, shut off. T 5-20.

Test of water shut-off satisfactory.

Well No. 38, alter casing. P 5-119.

Approved proposal to put in string of 4½" casing.

Well No. 39, commence drilling. P 5-152.

Recommended cementing at 3390' instead of 3415' as proposed.

Well No. 39, shut off. T 5-168.

8¼" casing cemented at 3400'. Test of water shut-off satisfactory.

Well No. 40, commence drilling. P 5-208.

Recommended cementing at 3390' instead of 3330' as proposed.

Well No. 40, shut off. T 5-201.

8¼" casing cemented at 3361'. Test of water shut-off satisfactory.

## SECTION 3.

## Southern Pacific Company, Fuel Oil Department.

Well No. 29, production test. T 5-12.

Test of lead-line sample showed .6% water. Test of water shut-off satisfactory.

Well No. 32, commence drilling. P 5-326.

Recommended cementing at 2590' instead of 2660' as proposed.

## SECTION 6.

## American Petroleum Company.

Well No. 16, redrill. P 5-189.

Approved proposal to redrill oil string.

Well No. 37, abandon. P 5-116.

Proposal approved.

Well No. 37, test of plug. T 5-100.

Test for location and hardness of cement satisfactory.

## Mercantile Crude Oil Company.

Well No. 6, commence drilling. P 5-55.

Proposed depth of water shut-off approved.

Well No. 6, shut off. T 5-79.

Test of water shut-off satisfactory.

## SECTION 7.

## Arica Oil Company (By Associated Oil Company).

Well No. 34, redrill. P 5-42.

Approved proposal to bridge and test water string.

Well No. 43, shut off. T 5-9.

Test of water shut-off satisfactory.

Coalinga Pacific Oil and Gas Company.

Well No. 1, redrill. P 5-76.

Approved proposal to redrill oil string.

Section Seven Oil Company.

Well No. 3, shut off. T 5-28.

Test of water shut-off satisfactory.

#### SECTION 8.

Union Oil Company of California.

California Coalinga Well No. 1, redrill. P 5-32.

Approved proposal to redrill, but recommended that 8 $\frac{1}{4}$ " water string be tested instead of cementing string of 6 $\frac{1}{4}$ " casing.

California Coalinga Well No. 1, test of casing. T 5-72.

Test showed that plug was below shoe of 8 $\frac{1}{4}$ " casing instead of inside of casing, as was supposed.

California Coalinga Well No. 1, test of casing. T 5-81.

Test showed leak in 8 $\frac{1}{4}$ " casing.

California Coalinga Well No. 1, supplementary redrill. P 5-136.

Approved proposal to redrill 6 $\frac{1}{4}$ " oil string and set packer in water string.

California Coalinga Well No. 3, commence drilling. P 5-60.

Proposed depth of water shut-off approved.

Coalinga Security Well No. 1, redrill. P 5-31.

Approved proposal to redrill oil string.

Coalinga Security Well No. 1, redrill. P 5-284.

Approved proposal to redrill oil string.

Coalinga Security Well No. 2, commence drilling. P 5-98.

Proposed depth of water shut-off approved.

Coalinga Security Well No. 3, commence drilling. P 5-61.

Proposed depth of water shut-off approved.

Coalinga Security Well No. 3, shut off. T 5-162.

Test showed that 10" casing failed to shut off top water. Recommended cementing 8 $\frac{1}{4}$ " at about 2793'.

Coalinga Security Well No. 3, cement deeper. P 5-262.

Approved proposal to mud up hole and cement 8 $\frac{1}{4}$ " at 2793'.

Coalinga Security Well No. 3, shut off. T 5-177.

Test of water shut-off satisfactory.

#### SECTION 11.

Southern Pacific Company, Fuel Oil Department.

Well No. 31, production test. T 5-13.

Tests of lead-line samples showed trace of water. Test of water shut-off satisfactory.

#### SECTION 12.

Wilcox Oil Company.

Well No. 1, abandon. P 5-117.

Approved proposal to plug and pull certain casings, leaving well in such condition that it will be possible to do further work if necessary.

Well No. 1, test of plug. T 5-83.

Location and hardness of cement satisfactory.

Coalinga Mohawk Oil Company.

Well No. 3, shut off. T 5-55.

Test indicated that 6 $\frac{1}{4}$ " water string does not shut off water.

Well No. 4, redrill. P 5-133.

Approved proposal to redrill oil string. This cancels prior notice of abandonment.

Well No. 6, redrill. P 5-143.

Approved proposal to redrill oil string.

## Coalinga Mohawk Oil Co.—Continued.

Well No. 8, plug bottom. P 5-3.

Approved proposal to plug off bottom water.

Well No. 9, shut off. T 5-47.

Test of water shut-off satisfactory.

Well No. 10, redrill. P 5-142.

Approved proposal to plug back and test upper oil sands above which 8½" casing was cemented to shut off top water.

Well No. 10, shut off. T 5-132.

6½" casing cemented at 4215'. Test of water shut-off satisfactory.

Well No. 11, shut off. T 5-110.

Test of water shut-off satisfactory.

## SECTION 14.

## Kyle and Lewis.

Vancouver California Well No. 1, abandon. P 5-80.

Approved proposal to abandon. This well probably did not encounter productive oil or gas sand.

## SECTION 18.

## American Petroleum Company.

Well No. 4, production test. T 5-3.

A test of lead-line sample showed that water conditions at this well are unsatisfactory.

Well No. 6, production test. T 5-1.

Test of lead-line sample indicated that packer on oil string shuts out top water.

Well No. 9, production test. T 5-2.

Test of lead-line sample indicates satisfactory water condition.

Well No. 28, deepen. P 5-185.

Approved proposal to mud upper oil sand and cement below intermediate water.

Well No. 28, shut off. T 5-205.

Test of water shut-off satisfactory.

## Lakeport Petroleum Company.

Well No. 24, shut off. T 5-99.

Test showed water coming through hole in water string, by running casing tester.

Well No. 24, alter casing. P 5-149.

Approved proposal to set packer on oil string after completion of drilling.

## Nevada Petroleum Company.

Well No. 5A, shut off. T 5-36.

Test indicated that water present was coming from oil sand. Recommended that drilling continue, after which a production test would be made.

Well No. 5A, recement. P 5-247.

Approved proposal to recement with 6½" casing.

Well No. 5A, shut off. T 5-180.

Test of water shut-off satisfactory.

Well No. 5C, redrill. P 5-129.

Approved proposal to redrill oil string. This cancels previous notice to abandon.

## SECTION 19.

## American Petroleum Company.

Well No. 3, production test. T 5-33.

Test of lead-line samples showed condition of well to be satisfactory.

Well No. 4, redrill. P 5-73.

Recommended that water string be tested and top water be shut off by recementing or setting packer.

Well No. 11, shut off. T 5-30.

Well passed for further drilling and production test.

## Southern Pacific Company, Fuel Oil Department.

Well No. 3, production test. A-360.

Test of lead-line sample warranted approval of water condition.

Well No. 3S, redrill. P 5-235.

Approved proposal to redrill oil string.

Well No. 55, commence drilling. P 5-336.

Proposed depth of water shut-off approved.

## SECTION 20.

## Nevada Petroleum Company.

Well No. 1, test for source of water. T 5-89.

Test was made to determine source of water by introducing muddy water into well. Test inconclusive.

Well No. 1, shut off. T 5-141.

Test of 6 $\frac{1}{4}$ " casing cemented at 3326' satisfactory.

Well No. 1, shut off. T 5-154.

After cementing 6 $\frac{1}{4}$ " below oil sands at 3327', well was drilled ahead into bottom water sand and circulation obtained through sand and side-tracked casing, and cement pumped through this opening up to water string. Present hole into bottom water sand plugged with cement. Test of this plug satisfactory.

Well No. 2A, commence drilling. P 5-342.

Recommended cementing at 3205' instead of 3190' as proposed.

## SECTION 30.

## R. L. Patterson.

Creme Petroleum Well No. 1, abandon. P 5-77.

Proposed depths of shooting and plugging approved.

Creme Petroleum Well No. 1, test of plug. T 5-75.

Location and hardness of cement satisfactory.

Creme Petroleum Well No. 2, abandon. P 5-130.

Depths of plugging approved.

Creme Petroleum Well No. 2, test of plugs. T 5-145.

Location and hardness of cement plugs satisfactory.

## American Petroleum Company.

Well No. 14, commence drilling. P 5-310.

Recommended cementing at 2230' instead of 2210' as proposed. The company's attention was called to the fact that a depth of 2210' is beyond the safe limit for 10" 40-lb. water string.

Well No. 15, commence drilling. P 5-309.

Proposed depth of water shut-off approved. Company's attention was called to the fact that a depth of 2225' is beyond the safe limit for 10" 40-lb. water string.

Well No. 16, commence drilling. P 5-308.

Proposed depth of water shut-off approved. Company's attention was called to the fact that 2200' is beyond the safe limit for 10" 40-lb. water string.

## Nevada Petroleum Company.

Well No. 7, redrill. P 5-272.

Approved proposal to repair damaged water string and pump for production test.

Well No. 1A, redrill. P 5-264.

Approved proposal to test 8 $\frac{1}{4}$ " water string for leak. If no leak is found, to mud upper oil sand and cement 6 $\frac{1}{4}$ " casing below it.

Well No. 5A, production test. T 5-15.

Test of lead-line sample showed an excessive amount of water. Recommended that well be pumped for further test.

Well No. 8A, shut off. T 5-19.

Test of water shut-off satisfactory.

Well No. 8A, redrill. P 5-273.

Approved proposal to bridge and test water string.

## SECTION 31.

Southern Pacific Company, Fuel Oil Department.

Well No. 65. Redrill. P 5-111.

Approved proposal to redrill oil string.

T. 21 S., R. 14 E., M.D.B. & M.

## SECTION 13.

S. N. Roof.

Well No. 1. Test of plugs. T 5-25.

Location and hardness of cement satisfactory.

T. 21 S., R. 15 E., M.D.B. & M.

## SECTION 6.

Los Angeles Coalinga Oil Syndicate.

Well No. 1. Abandon. P 5-321.

Approved proposal to abandon, specifying depths of shooting and plugging.

Muriel Oil Company.

Well No. 1. Redrill. P 5-123.

Approved proposal to test water string and oil sands for production.

Well No. 1. Supplementary redrill. P 5-167.

Approved proposal to cement 6 $\frac{3}{8}$ " casing to shut off top water.

Well No. 1. Shut-off. T 5-124.

Test of water shut-off inconclusive. Recommended further plugging and testing.

Well No. 1. Abandon. P 5-225.

Approved proposal to abandon by pulling casing and mudding well under pressure.

Coalinga Red Top Oil Company.

Well No. 1. Abandon. P 5-174.

Approved proposal to plug and pull a portion of casing.

Well No. 1. Test of plug. T 5-113.

Location and hardness of cement plug satisfactory.

Jefferson Oil Company.

Well No. 2. Deepen. P 5-180.

Approved proposal to deepen and test lower oil sands.

Well No. 2. Supplementary deepen. P 5-202.

Approved proposal to cement in 8 $\frac{1}{4}$ " liner.

Well No. 2. Shut-off. T 5-159.

Test inconclusive. Approved proposal to drill ahead and make further bailing test.

Well No. 2. Plug bottom. P 5-299.

Approved proposal to plug bottom.

Lucile Oil Company.

Well No. 1. Redrill. P 5-54.

Approved proposal to redrill oil string.

Well No. 1. Redrill. P 5-108.

Approved proposal to remove 4 $\frac{1}{2}$ " casing and recommended further testing for water shut-off.

Well No. 2. Redrill. P 5-30.

Approved proposal to redrill oil string and test water string.

Well No. 2. Shut-off. T 5-77.

Test of water shut-off satisfactory.

Marian Oil Company.

Well No. 1. Shut-off. T 5-10.

Bailing test inconclusive. Recommended pumping test.

Pacific States Petroleum Company.

Well No. 2. Redrill. P 5-159.

Approved proposal to redrill and shut-off water.

SECTION 26.

Banting Iron Works.

Azores Oil Company Well No. 1. Redrill. P 5-64.

Approved proposal to plug, test shut-off, and attempt to produce.

Azores Well No. 1. Redrill. P 5-148.

Approved proposal to cement  $4\frac{1}{2}$ " casing to shut off top water.

T. 21 S., R. 16 E., M.D.B. & M.

SECTION 30.

R. L. Patterson.

Kaweah Oil Development Co. Well No. 1. Abandon. P 5-228.

Approved proposal to abandon without plugging.

T. 22 S., R. 16 E., M.D.B. & M.

SECTION 32.

Pine Ridge Petroleum Company.

Well No. 1. Commence drilling. P 5-300.

Prospect well.

T. 23 S., R. 16 E., M.D.B. & M.

SECTION 10.

Section 10 Oil Company.

Well No. 1. Commence drilling. P 5-269.

Prospect well.

## CHAPTER VIII.

## DIRECTORY OF OIL OPERATORS.

(Revised to December 1, 1918.)

The date following each name is that of incorporation. The amount of money shown is the authorized capitalization. This information is from the records of the State Board of Equalization.

Star before name indicates that the concern produced oil or gas during the calendar year 1917. The number of wells, followed by the name of a county, means the wells actually producing in said county on December 31, 1917. The information relative to wells, production, and location is from sworn statements filed with the State Mineralogist in 1918, prior to March 14.

This directory contains names of all oil producers, and, in addition, many concerns which are connected with the oil industry, either by mere incorporation or as land-owners. It is difficult to correctly list or classify those outside of actual producers.

**\*A. & J. OIL COMPANY,**

400 H. W. Hellman Bldg., Los Angeles,  
Cal. A. J. Jergins, President. H. J.  
Haase, Secretary. April 25, 1914.  
\$80,000. Three wells, Kern County.

**ACME OIL AND GAS PRODUCING COMPANY,**

1021 American Bank Bldg., San Diego,  
Cal. April 1, 1918. \$25,000.

**ÆTNA OIL, MINING AND DEVELOPING COMPANY,**

748 Gladys Ave., Los Angeles, Cal.  
Wm. H. Smith, President. Dwight B.  
Harris, Secretary. May 14, 1913.  
\$25,000.

**ÆTNA PETROLEUM COMPANY,**

350 California St., San Francisco, Cal.  
John Lawson, President. George S.  
Tyler, Secretary. April 20, 1899.  
\$50,000 Orig. \$500,000 Inc.

**ALADDIN OIL COMPANY,**

409 Consolidated Realty Bldg., Los Angeles, Cal. Wm. Mead, President. L. Schenck, Secretary. September 17, 1900. \$250,000. Kern County.

**\*ALASKA PIONEER OIL COMPANY,**

264 Southern Pacific Bldg., San Francisco, Cal. Wm. Chappell, President. W. J. Clark, Secretary. March 18, 1910. \$500,000. Six wells, Kern County.

**ALLIANCE OIL COMPANY,**

354 Pine St., San Francisco, Cal. L. A. Phillips, President. H. P. Coles, Secretary. July 22, 1909. \$3,000,000.

**\*ALMA OIL COMPANY,**

517 Pacific Bldg., Oakland, Cal. C. E. Thomas, President. M. A. Thomas, Secretary. June 22, 1900. \$400,000. Eighteen wells, Kern County.

**ALMO OIL COMPANY,**

Lemoore, Cal. L. H. Byron, President. L. L. Follett, Secretary. June 23, 1904. \$50,000.

**ALTOONA, MIDWAY OIL COMPANY,**

Room 72, Altoona Trust Bldg., Altoona, Pa. R. W. A. Jamison, President. J. H. Fiske, Secretary. February 20, 1909. \$500,000. Kern County.

**ALVARADO OIL COMPANY,**

1114 Union Oil Bldg., Los Angeles, Cal. L. H. Mitchell, President; V. C. McCollough, Secretary. February 23, 1904. \$300,000.

**\*AMALGAMATED OIL COMPANY,**

55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. October 27, 1904. \$5,000,000. Thirty wells, Orange County; six wells, Los Angeles County.

**AMAZON OIL COMPANY,**

410 Citizens Savings Bank Bldg., Pasadena, Cal. A. K. Nash, President. R. H. Pinney, Secretary. September 26, 1900. \$400,000. Kern County.

**AMBER OIL COMPANY,**

803 Baker St., East Bakersfield, Cal. John Kincaid, President. S. K. Dickinson, Secretary. July 19, 1900. \$500,000. Kern County.

**\*AMERICAN CRUDE OIL COMPANY,**

Room 1115, 456 S. Spring St., Los Angeles, Cal. Wm. Fitzherbert West, President. January 3, 1912. \$500,000. Nine wells, Kern County.

**\*AMERICAN OILFIELDS COMPANY,**

1034 Security Bldg., Los Angeles, Cal. I. M. Fuqua, Vice President. Norman Bridge, Secretary. January 10, 1910. \$25,000,000. Forty-five wells, Kern County.

**AMERICAN PACIFIC OIL AND REFINING COMPANY,**

333 Van Nuys Bldg., Los Angeles, Cal. July 12, 1918. \$100,000.

**\*AMERICAN PETROLEUM COMPANY,**

1034 Security Bldg., Los Angeles, Cal. W. D. Stewart, Vice President. Norman Bridge, Secretary. February 7, 1908. \$10,000,000. Orig.; \$15,000,000. Inc. Ninety-two wells, Fresno County.

**\*AMERICAN VENTURA OIL COMPANY (Arizona Corporation),**

452 I. W. Hellman Bldg., Los Angeles, Cal. J. M. Herndon, President. J. C. Miller, Secretary. Ventura County.

**\*AMITY OIL COMPANY,**

607 First National Bank Bldg., San Francisco, Cal. R. H. Smith, President. A. Whearty, Secretary. August 31, 1911. \$500,000. Six wells, Fresno County.

**\*AMY OIL COMPANY,**

Box 28, Coalinga, Cal. A. P. May, President. C. E. Haliburton, Secretary. November 14, 1908. \$50,000. One well, Fresno County.

**\*ANCHOR OIL COMPANY,**

Maricopa, Cal. Jules H. Preston, President. Bernard T. Lennon, Secretary. January 19, 1917. \$300,000. Fourteen wells, Kern County.

**ANGLO-CALIFORNIAN OIL SYNDICATE, LIMITED,**

Care W. J. Packard, Bank of Lompoc Bldg., Lompoc, Cal. John Chapman, President. G. J. Stimson, Secretary. July 17, 1906. \$50,000.

**\*APOLLO OIL COMPANY,**

507 Foxcroft Bldg., San Francisco, Cal. Wm. E. Miles, President. A. J. Weston, Secretary. February 13, 1901. \$20,000. Nineteen wells, Kern County.

**\*ARCTURUS OIL COMPANY,**

55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. February 12, 1904. \$400,000. Twenty-five wells, Los Angeles County.

**AREQUIPA OIL COMPANY,**

245 Holbrook Bldg., San Francisco, Cal. O. Scribner, President. G. Sheridan, Secretary. January 5, 1909. \$500,000. Kern County.

**\*ARICA OIL COMPANY,**

55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. January 5, 1909. \$500,000. Twelve wells, Fresno County.

**ARIZONA OIL COMPANY,**

824 Crocker Bldg., San Francisco, Cal. T. C. Petersen, General Manager. July 20, 1918. \$2,500,000. (Formerly Peerless Oil Company.)

**\*ARIZONA PETROLEUM COMPANY,**

1122 Title Insurance Bldg., Los Angeles, Cal. J. A. Brown, President. E. W. Forgy, Secretary. March 13, 1910. \$250,000. Seven wells, Fresno County. (From June to August, 1918, property operated by Harris & Cates. From September, 1918, property operated by C. B. Cates & Co.)

**\*ASSOCIATED OIL COMPANY,**

55 New Montgomery St., San Francisco, Cal. Paul Shoup, President. P. G. Williams, Secretary. October 7, 1901. \$40,000,000. Sixty-three wells, Fresno County; 712 wells, Kern County; 5 wells, Santa Barbara County.

**ASSOCIATED OIL COMPANY OF NEVADA,**

55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. October 2, 1916. \$25,000.

**ATLANTIC AND WESTERN OIL COMPANY,**

Livermore, Cal. Wm. W. French, Agent. September 14, 1917. \$1,000,000.

**ATLAS CRUDE OIL COMPANY,**

Title Insurance Bldg., Los Angeles, Cal. G. M. Giffen, President. Theo. A. Simpson, Secretary. July 14, 1900. \$30,000.

**ATLAS DEVELOPMENT COMPANY,**

1351 E. 26th St., Oakland, Cal. L. A. Moberry, President. J. Somers, Secretary. January 11, 1918. \$15,000.

**AUGUST OIL COMPANY,**

P. O. Box 635, Fresno, Cal. F. A. Hoeman, President. A. W. Burdick, Secretary. April 4, 1910. \$1,000,000.

**\*AUGUSTINE & BUTZ,**

Coalinga, Cal. Six wells, Fresno County.

**AVENAL LAND AND OIL COMPANY,**

350 California St., San Francisco, Cal. John Lawson, President. R. D. Blake, Secretary. April 20, 1899. \$500,000.

**AZORES OIL COMPANY,**

206 N. Dooty St., Hanford, Cal. M. J. Caetano, President. Wilhelmina Nunes, Secretary. January 20, 1909. \$50,000.

**BABY KINGS OIL AND MINERAL COMPANY,**

P. O. Box 416, Hanford, Cal. F. B. Skinner, President. W. R. McQuiddy, Secretary. December 8, 1897. \$64,000.

**\*BAKER & HENSHAW,**

Lost Hills, Cal. Two wells, Kern County.

**BAKERSFIELD AND FRESNO OIL COMPANY,**

Care F. E. Cook, Box 688, Fresno, Cal. H. M. Rodgers, President. F. E. Cook, Secretary. August 31, 1899. \$100,000. Kern County.

**BAKERSFIELD FUEL AND OIL COMPANY,**

1805 Tucker St., Selma, Cal. W. H. Shafer, President. Chas. A. Lee, Secretary. July 31, 1899. \$16,000.

**BALBOA OIL COMPANY,**

525 Spreckels Bldg., San Diego, Cal. A. J. Taylor, President. J. Wiseman, Secretary. June 10, 1912. \$500,000.

**BALD EAGLE JUNIOR OIL COMPANY,**

P. O. Box 308, Napa, Cal. E. H. Winship, President. J. E. Beard, Secretary. February 1, 1901. \$175,000.

**\*BALD EAGLE OIL COMPANY,**

110 Sutter St., San Francisco, Cal. Geo. M. Brown, President. Allie G. Lange, Secretary. January 7, 1901. \$500,000. Thirteen wells, Kern County.

**BALDWIN-STOCKER OIL ESTATES,**

414 Merritt Bldg., Los Angeles, Cal. One well, Los Angeles County.

**\*BANKERS OIL COMPANY,**

703 Citizens National Bank Bldg., Los Angeles, Cal. Orra E. Monnette, President. M. J. Monnette, Secretary. November 24, 1909. \$1,000,000. Thirty-four wells, Kern County.

**\*BANKLINE OIL COMPANY,**

324 Sansome St., San Francisco, Cal. John Barneson, President. J. Leslie Barneson, Secretary. May 20, 1912. \$200,000. Twenty-one wells, Kern County.

**BANNER OIL COMPANY,**

520 Union Oil Bldg., Los Angeles, Cal. J. H. Strine, President. Ruben S. Schmidt, Secretary. September 12, 1891. \$10,000.

**BARDSDALE CANYON OIL COMPANY,**

300 S. Harvard Blvd., Los Angeles, Cal. Chas. F. Hurd, President. Thos. Pascoe, Secretary. May 16, 1901. \$20,000. (Dissolved.)

- \*BARSDALE CRUDE OIL COMPANY,**  
514 Federal Bldg., Los Angeles, Cal.  
A. F. Schiffman, President. Chas. A.  
Shaw, Secretary. June 18, 1900.  
\$200,000. Eight wells, Ventura County.
- BARNODON OIL COMPANY,**  
310 Sansome St., San Francisco, Cal.  
John Barneson, President. W. J.  
Dinsmore, Secretary. April 9, 1910.  
\$1,000,000.
- BARTOW SAN ANTONIO OIL COM-  
PANY,**  
9 Beech St., Detroit, Michigan, care  
W. L. Hogan. January 16, 1915.  
\$100,000.
- BARTOLO OIL COMPANY,**  
1124 Merchants National Bank Bldg.,  
Los Angeles, Cal. L. P. Tappeiner,  
President. G. C. O'Connell, Secretary.  
August 7, 1916. \$100,000.
- BAY CITY OIL COMPANY,**  
30 S. Raymond Ave., Los Angeles, Cal.  
J. H. Dorn, President. Ira J. H.  
Sykes, Secretary. October 28, 1899.  
\$500,000. Kern County.
- BEAR CREEK OIL COMPANY,**  
19 Howard Canfield Bldg., Santa Bar-  
bara, Cal. J. A. Hurlburt, President.  
A. R. Edmondson, Secretary. July 12,  
1913. \$10,000.
- \*BEATTY OIL AND DEVELOPMENT  
COMPANY,**  
930 California Bldg., Los Angeles, Cal.  
S. W. Beatty, President. H. M. Fos-  
ter, Secretary. February 10, 1913.  
\$470,000. Two wells, Ventura County.
- \*G. F. BECKER,**  
Summerland, Cal. Sixty-four wells,  
Santa Barbara County.
- BED ROCK OIL COMPANY,**  
1114 Union Oil Bldg., Los Angeles, Cal.  
W. W. Orcutt, President. John Mc-  
Peak, Secretary. January 4, 1909.  
\$50,000.
- \*BEER OIL COMPANY, J. C.,**  
407 First National Bank Bldg., Long  
Beach, Cal. J. C. Beer, President.  
H. Hoddenpytle, Secretary. March 23,  
1912. \$100,000. Three wells, Kern  
County. (Property now operated by  
E. B. Campbell, Bakersfield, Cal.)
- BELL OF MONTEBELLO OIL COM-  
PANY,**  
318 H. W. Hellman Bldg., Los Angeles,  
Cal. November 25, 1918. \$100,000.
- BELL OIL COMPANY,**  
303 Fay Bldg., Los Angeles, Cal. C. E.  
Lapp, President. J. W. Eberle, Secre-  
tary. July 2, 1910. \$100,000.
- BELMONT OIL COMPANY,**  
601 D St., Chino, Cal. O. J. Newman,  
President. Edwin Rhodes, Secretary.  
September 13, 1899. \$200,000.
- \*BELRIDGE OIL COMPANY,**  
617 Merritt Bldg., Eighth and Broad-  
way, Los Angeles, Cal. Burton E.  
Green, President. F. B. Sutton, Secre-  
tary. January 25, 1911. \$1,000,000.  
Eighty wells, Kern County.
- BEQUETTE OIL COMPANY,**  
Visalia, Cal. Paschal Bequette, Presi-  
dent. N. F. Bradley, Secretary.  
January 16, 1900. \$9,000.
- \*BERKELEY COALINGA OIL COM-  
PANY,**  
Care of W. L. W. Miller, 340 California  
St., San Francisco, Cal. Fresno  
County.
- BERKELEY PARAFFINE OIL COM-  
PANY,**  
1804 Grant St., Berkeley, Cal. Geo. H.  
DeKay, President. J. H. Allen, Secre-  
tary. July 6, 1912. \$1,000,000.
- \*BERRY, F. C.,**  
Selma, Cal. Five wells, Kern County.
- \*BERRY, C. J., and KELLER, F. L.,**  
597 Monadnock Bldg., San Francisco,  
Cal. Eighteen wells, Kern County.
- BEST YET OIL COMPANY, THE,**  
Box 187, Coalinga, Cal. O. D. Loftus,  
President. Guy H. Salisbury, Secre-  
tary. October 29, 1909. \$150,000.
- \*BETTS, GEORGE A.,**  
R. F. D. No. 5, Bakersfield, Cal. Seven  
wells, Kern County.
- \*B. H. C. OIL COMPANY,**  
208 Brower Bldg., Bakersfield, Cal.  
C. L. Claffin, President. W. H. Hill,  
Secretary. September 18, 1908. \$15,-  
000. Six wells, Kern County.
- \*BIG SESPE OIL COMPANY OF CALI-  
FORNIA,**  
609 N. Main St., Santa Ana, Cal. L. A.  
Clampitt, President. I. D. Mills, Sec-  
retary. September 4, 1896. \$500,000.  
Two wells, Ventura County.
- \*BIRCH OIL COMPANY,**  
R. F. D., Fullerton, Cal. A. Otis Birch,  
General Manager. Ten wells, Orange  
County. (Copartnership.)
- \*BLANCK & HEASLEY,**  
Care of Lawton & Blanck, Inc., Fellows,  
Cal. Two wells, Kern County.
- BLUE DIAMOND OIL COMPANY,**  
Grass Valley, Cal. W. G. Thomas,  
President. L. P. Larue, Secretary.  
October 15, 1900. \$100,000.
- J. S. BOOK OIL AND INVESTMENT  
COMPANY,**  
521 Washington Bldg., Los Angeles, Cal.  
Dr. W. P. Book, President. G. E.  
Delavan, Jr., Secretary. February 8,  
1913. \$50,000.
- \*BOSTON PACIFIC OIL COMPANY,**  
204-5 Sharon Bldg., San Francisco, Cal.  
Fred. G. King, President. E. B.  
Cushman, Secretary. December 12,  
1911. \$1,000,000. Two wells, Kern  
County.
- \*BOSTON PETROLEUM COMPANY,**  
131 State St., Boston, Mass. Arthur  
Winslow, President. Henry L. Rand,  
Secretary. March 21, 1910. \$500,000.  
Seventeen wells, Kern County.
- BOYCHESTER OIL COMPANY,**  
Care of J. A. Fleutsch, Secretary, Coa-  
linga, Cal. W. C. Rielly, President.  
May 19, 1909. \$100,000.
- \*BRAD OIL COMPANY, LTD.,**  
Box 178, Taft, Cal. E. D. Taylor,  
Secretary. One well, Kern County.  
(Property sold to Montana-Wyoming  
Oil Company, October 11, 1917.)

**BRADFORD OIL COMPANY,**

110 Market St., Room 405, San Francisco, Cal. P. G. Goode, Vice President. Louis Nathan, Secretary. May 17, 1899. \$250,000.

**\*BREA CANON OIL COMPANY,**

1117 Trust and Savings Bank Bldg., Los Angeles, Cal. Dan Murphy, President. G. Holterhoff, Jr., Secretary. July 26, 1899. \$200,000. Twenty-two wells, Orange County.

**BRICELAND OIL COMPANY,**

Briceland, Cal. J. W. Bowden, President. W. E. Smith, Secretary. April 22, 1913. \$150,000.

**BRITISH AMERICAN OIL COMPANY,**

Box 598, Santa Monica, Cal. Frank R. Strong, President. Roy Jones, Secretary. August 26, 1907. \$1,250,000. Orig.; \$100,000. Dec. Kern County.

**BRONCHO OIL COMPANY,**

9 Main St., San Francisco, Cal. Chas. A. Son, President. A. N. Baldwin, Secretary. November 19, 1908. \$100,000.

**\*BRONCHO OIL LEASE,**

801 Garland Bldg., Los Angeles, Cal. Wm. G. Kerckhoff, Owner. One well, Kern County.

**\*BROOKS OIL COMPANY,**

519 California St., Room 308, San Francisco, Cal. B. F. Brooks, President. C. L. Brooks, Secretary. October 2, 1908. \$500,000. One well, Santa Barbara County.

**\*BROOKSHIRE OIL COMPANY,**

San Luis Obispo, Cal. J. W. Barneberg, President. Henry Bahr, Secretary. December 1, 1902. \$500,000. Two wells, Kern County; four wells, Santa Barbara County.

**BROWN EAGLE OIL COMPANY,**

300 E. Main St., Visalia, Cal. John Frans, President. J. Sub Johnson, Secretary. February 10, 1910. \$75,000.

**BROWN OIL COMPANY,**

Care Southern Hotel, Bakersfield, Cal. P. S. Brown, President. S. L. Mack, Secretary. January 29, 1900. \$250,000.

**\*BUENA FE PETROLEUM COMPANY,**

1015 Security Bldg., Los Angeles, Cal. W. D. Stewart, President. E. L. Doeheny, Jr., Secretary. November 3, 1915. \$10,000. Fifty-three wells, Kern County. (Property transferred to Pan American Petroleum Company, October 18, 1917.)

**BUENA VISTA OIL COMPANY,**

519 Story Bldg., 610 S. Broadway, Los Angeles, Cal. J. M. McLeod, President. C. C. Barnsback, Secretary. July 23, 1914. \$1,500,000. Kern County.

**BUICK OIL COMPANY,**

520 Central Bldg., Los Angeles, Cal. W. J. Fabling, Vice President. Fred Van Orman, Secretary. March 7, 1910. \$5,000,000. Kern County.

**BULL DOG OIL COMPANY,**

617 Merritt Bldg., Los Angeles, Cal. M. H. Whittier, President. H. L. Westbrook, Secretary. March 6, 1911. \$300,000.

**BUNKER HILL OIL MINING COMPANY,**

110 Sutter St., San Francisco, Cal. J. W. Wright, President. B. T. Harrington, Secretary. November 9, 1899. \$500,000. Kern County.

**E. D. BURGE OIL COMPANY,**

P. O. Box 813, Bakersfield, Cal. E. D. Burge, President. C. H. Franey, Secretary. December 11, 1914. \$50,000.

**\*CALEX OIL COMPANY,**

1913 Chester Ave., Bakersfield, Cal. H. A. Jastro, President. E. S. St. Clair, Secretary. August 23, 1915. \$24,000. Kern County.

**\*CALIDON PETROLEUM SYNDICATE,**

350 California St., San Francisco, Cal. Two wells, Kern County. (Operated by the Balfour-Guthrie Investment Company, R. F. MacLeod, Secretary.)

**CALIENTE OIL AND LAND COMPANY,**

307 Grant Bldg., Los Angeles, Cal. Geo. C. Fetterman, President. July 17, 1916. \$50,000.

**CALIFORNIA COALINGA OIL COMPANY,**

Monadnock Bldg., San Francisco, Cal. Care Wm. H. H. Hart. March 27, 1917. \$3,000,000. Fresno County. (Dissolved.)

**\*CALIFORNIA COAST OIL COMPANY,**

1114 Union Oil Bldg., Los Angeles, Cal. W. L. Stewart, President. John McPeak, Secretary. September 10, 1903. \$200,000. Nine wells, Santa Barbara County.

**\*CALIFORNIA COUNTIES OIL COMPANY,**

58 Sutter St., San Francisco. J. E. Woodbridge, President. E. A. Richards, Secretary. February 11, 1911. \$500,000. Kern County. (Sold to General Petroleum Corporation, August 1, 1917.)

**CALIFORNIA-DAKOTA OIL COMPANY,**

Kerman, Cal. R. C. Heims, President. Walter L. Hart, Secretary. October 27, 1913. \$25,000.

**CALIFORNIA FRESNO OIL COMPANY,**

Box 823, Fresno, Cal. A. C. Ruschhaupt, President. A. Bultner, Secretary. October 31, 1901. \$50,000.

**CALIFORNIA MIDWAY OIL COMPANY,**

500 H. W. Hellman Bldg., Los Angeles, Cal. B. W. McCausland, President. J. H. Nolan, Secretary. January 13, 1912. \$1,500,000. Kern County.

**CALIFORNIA MISSOURI PETROLEUM COMPANY,**

108 Morgan Bldg., Bakersfield, Cal. Care Thomas Scott. December 17, 1917. \$100,000. (Dissolved.)

**\*CALIFORNIA OIL COMPANY,**

532 Fifteenth St., Oakland, Cal. B. B. Dudley, President. E. R. Arner, Secretary. September 28, 1917. \$4,000,000. Eighteen wells, Kern County; 6 wells, San Luis Obispo County.

**CALIFORNIA OIL COMPANY,**

516 Grant Bldg., Los Angeles, Cal. June 7, 1901. \$1,000,000. (Company revived by Secretary of State, August 16, 1918.)

**CALIFORNIA OIL AND ASPHALT COMPANY, THE,**

304 Grosse Bldg., Los Angeles, Cal. May 5, 1916. \$50,000.

**\*CALIFORNIA OIL AND GAS COMPANY,**

Box B-2, Coalinga, Cal. W. M. Graham, President. Warren H. Spurge, Secretary. February 9, 1912. \$1,000,000. Four wells, Fresno County.

**CALIFORNIA OIL DEVELOPMENT SYNDICATE,**

326 Wilcox Bldg., Los Angeles, Cal. J. D. Miller, President. Janet I. Miller, Secretary. November 15, 1916. \$3,000.

**CALIFORNIA OIL LAND COMPANY, THE,**

2002 Hobart Bldg., San Francisco, Cal. A. F. Burke, President. L. T. Young, Secretary. May 17, 1912. \$50,000.

**CALIFORNIA RELIANCE OIL COMPANY,**

317 Tajo Bldg., Los Angeles, Cal. Thurston Daniels, President. Minnie Daniels, Secretary. April 11, 1910. \$1,500,000.

**\*CALIFORNIA STAR OIL COMPANY,**

1004 Security Bldg., Los Angeles, Cal. M. H. Whittier, President. Ellis T. Yarnell, Secretary. May 20, 1915. \$2,000,000. Thirty-four wells, Kern County.

**CALIFORNIA WYOMING OIL COMPANY,**

102 Taylor Bldg., Bakersfield, Cal. E. U. Combs, President. J. B. Johnson, Secretary. April 10, 1917. \$3,000.

**CALIZONA OIL COMPANY,**

509 Hibernian Bldg., Los Angeles, Cal. March 8, 1918. \$1,000,000.

**\*CALL OIL COMPANY,**

1927 Mariposa St., Fresno, Cal. D. A. Ewing, President. W. O. Miles, Secretary. January 8, 1901. \$250,000. Three wells, Fresno County.

**\*CALLOMA OIL COMPANY,**

1913 Chester Ave., Bakersfield, Cal. H. A. Jastro, President. E. S. St. Clair, Secretary. February 15, 1904. \$200,000. Kern County.

**\*CALOKLA OIL COMPANY,**

537 Title Insurance Bldg., Los Angeles, Cal. H. F. Sinclair, President. E. M. Riese, Secretary. November 5, 1913. \$250,000. Three wells, Orange County.

**CALTRONA OIL COMPANY,**

409 Hosfield Bldg., Los Angeles, Cal. Herman P. Cortelyou, President. John W. Cooke, Secretary. January 10, 1907. \$8,000.

**\*CALUMET OIL COMPANY,**

517 I. W. Hellman Bldg., Los Angeles, Cal. F. L. Wright, President. A. N. Gage, Secretary. April 7, 1911. \$1,000,000. Seven wells, Ventura County.

**CAMARILLO OIL COMPANY,**

210 W. Seventh St., Los Angeles, Cal. H. J. Daulton, President. L. N. Stott, Secretary. April 22, 1910. \$100,000.

**CAMERON OIL COMPANY OF CALIFORNIA,**

402 Laughlin Bldg., Los Angeles, Cal. D. F. Lehigh, President. J. O. Lehigh, Secretary. April 23, 1914. \$25,000.

**CAMPBELL, E. B.,**

Bakersfield, Cal. (Operating property of J. C. Beer Oil Company.)

**\*CANADIAN COALINGA OIL COMPANY, LTD.,**

739 Hastings St., West, Vancouver, B. C. E. J. McFeely, President. R. J. Cromie, Secretary. October 10, 1910. \$1,500,000. One well, Fresno County. A. J. Pollak, Agent, Mills Bldg., San Francisco, Cal.

**\*CANADIAN PACIFIC OIL COMPANY OF BRITISH COLUMBIA, LTD.,**

P. O. Box 27, Taft, Cal. W. H. Waddell, Field Manager. Three wells, Kern County.

**CANTIN LAND, OIL AND DEVELOPMENT COMPANY,**

68 Post St., San Francisco, Cal. A. A. Cantin, President. L. B. O'Farrell, Secretary. February 8, 1910. \$10,000.

**\*CAPITOL CRUDE OIL COMPANY,**

637 Consolidated Realty Bldg., Los Angeles, Cal. M. H. Sherman, President. A. I. Smith, Secretary. April 26, 1894. \$300,000. Twelve wells, Ventura County.

**\*CARBO PETROLEUM COMPANY,**

Box 34, Bakersfield, Cal. T. M. Young, President. G. R. Peckham, Secretary. July 15, 1909. \$500,000. Ten wells, Kern County.

**\*CARIBOU OIL MINING COMPANY,**

264 Southern Pacific Bldg., San Francisco, Cal. H. H. Hart, President. W. J. Clark, Secretary. June 3, 1899. \$1,000,000. Twenty-two wells, Fresno County; 3 wells, Kern County.

**\*CARPENTER, JACK,**

Maricopa, Cal. H. C. Treat, Manager. Two wells, Kern County.

**CARREC OIL COMPANY,**

264 Southern Pacific Bldg., San Francisco, Cal. H. H. Hart, President. W. J. Clark, Secretary. September 25, 1914. \$100,000.

**CARRIE NATION OIL COMPANY,**

Lemoore, Cal. L. Y. Trout, President. F. B. Graves, Secretary. December 23, 1908. \$25,000.

**CASCADE OIL COMPANY,**

805 Hollingsworth Bldg., Los Angeles, Cal. H. A. Dunn, President. F. R. Campbell, Secretary. April 28, 1916. \$10,000.

**\*CASMALIA SYNDICATE,**

55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. March 30, 1916. \$1,000,000. Seven wells, Santa Barbara County.

**CASTLE OIL COMPANY,**

1118 Hearst Bldg., San Francisco, Cal. H. A. Whitley, President. J. R. Whitmire, Secretary. March 19, 1910. \$600,000.

**CATES & CO., C. B. (See Harris & Cates).**

701 College Ave., Los Angeles, Cal. (Operating Strong Oil Lease, and Arizona Petroleum Lease, since September, 1918.)

**CAVE DALE OIL AND DEVELOPMENT COMPANY,**

1332 Evans Ave., San Francisco, Cal.  
S. Pliser, President. H. Saxl, Secretary.  
December 8, 1914. \$200,000.

**CENTRAL CALIFORNIA OIL COMPANY,**

1114 Union Oil Bldg., Los Angeles, Cal.  
Frank R. Barrett, President. May 22,  
1886. \$200,000.

**\*CENTRAL OIL COMPANY OF LOS ANGELES,**

404 H. W. Hellman Bldg., Los Angeles,  
Cal. I. A. Lothian, President. Robert  
N. Bulla, Secretary. January 2, 1900.  
\$750,000, Orig.; \$3,000,000, Inc. Fifty-  
two wells, Los Angeles County.

**\*CHANSLOR-CANFIELD MIDWAY OIL COMPANY,**

Room 756, Kerckhoff Bldg., Los Angeles,  
Cal. E. P. Ripley, President. G. Hol-  
terhoff, Jr., Secretary. August 15,  
1901. \$5,000,000. One hundred eighty-  
nine wells, Kern County.

**\*CHENEY STIMSON OIL COMPANY,**

518 Investment Bldg., Los Angeles, Cal.  
A. L. Cheney, President. December  
17, 1909. \$100,000. Six wells, Kern  
County. (Company changed name to  
Five Star Oil Company, July 5, 1918.)

**CHEROKEE DEVELOPMENT COM-  
PANY,**

Care of J. N. Bingham, P. O. Box 388,  
Fresno, Cal.

**CHINO OIL COMPANY,**

224 H. W. Hellman Bldg., Los Angeles,  
Cal. E. J. Marshall, President. John  
F. Horton, Secretary. October 18,  
1907. \$50,000.

**C. H. OIL COMPANY,**

264 Southern Pacific Bldg., San Fran-  
cisco, Cal. Wm. Chappell, President.  
W. J. Clark, Secretary. December 5,  
1911. \$100,000.

**\*CIRCLE OIL COMPANY,**

502 Balboa Bldg., San Francisco, Cal.  
T. A. O'Donnell, President. O. G.  
Myers, Secretary. April 10, 1908.  
\$100,000. One well, Fresno County.

**\*CLAMPITT, E. A.,**

1037 N. Alameda St., Los Angeles, Cal.  
Twenty-six wells, Kern County; 39  
wells, Los Angeles County.

**\*CLAMPITT, E. A. & D. L.,**

1037 N. Alameda St., Los Angeles, Cal.  
Nine wells, Los Angeles County.

**\*CLAREMONT OIL COMPANY,**

1114 Union Oil Bldg., Los Angeles, Cal.  
W. L. Stewart, President. R. Bruce  
Wallace, Secretary. January 25, 1901.  
\$100,000. Five wells, Fresno County;  
13 wells, Kern County.

**COALINGA CENTRAL OIL COMPANY,**

1913 Chester Ave., Bakersfield, Cal.  
E. S. St. Clair, President. F. C. St.  
Clair, Secretary. April 9, 1910.  
\$600,000.

**COALINGA CROWN OIL COMPANY,**

Temple Bar Bldg., Fresno, Cal. A. M.  
Drew, Secretary. September 17, 1909.  
\$300,000.

**\*COALINGA EMPIRE OIL COMPANY,**

1118 Hearst Bldg., San Francisco, Cal.  
H. A. Whitley, President. Stanley  
Pegger, Secretary. October 28, 1914.  
\$1,000,000. Fresno County.

**COALINGA FOUR OIL COMPANY,**

1034 Security Bldg., Los Angeles, Cal.  
T. A. O'Donnell, President. R. L.  
Peeler, Secretary. May 8, 1907. \$50,000.

**COALINGA HOMESTAKE OIL COM-  
PANY,**

Box 463, Coalinga, Cal. A. P. May,  
President. Geo. E. H. Satchell, Secre-  
tary. July 29, 1909. \$100,000. Fresno  
County.

**COALINGA LOST HILLS OIL COM-  
PANY,**

1034 Security Bldg., Los Angeles, Cal.  
R. C. Baker, President. R. L. Peeler,  
Secretary. January 4, 1911. \$50,000.

**\*COALINGA LUBRICATING OIL COM-  
PANY,**

403 Citizens National Bank Bldg., Los  
Angeles, Cal. R. A. Collins, Presi-  
dent. G. H. Rathman, Secretary.  
January 27, 1917. \$100,000. Three  
wells, Fresno County.

**\*COALINGA MOHAWK OIL COMPANY,**

611 Balboa Bldg., San Francisco, Cal.  
Alfred L. Meyerstein, President. E.  
Tourtellot, Secretary. April 15, 1907.  
\$500,000. Four wells, Fresno County.

**\*COALINGA MONTEREY OIL COM-  
PANY,**

201 Main St., Salinas, Cal. E. A. Nick-  
erson, President. Luther Rodgers,  
Secretary. March 17, 1910. \$2,000,000.  
Three wells, Kern County.

**\*COALINGA NATIONAL PETROLEUM  
COMPANY,**

310 Sansome St., San Francisco, Cal.  
John Barneson, President. Virgil F.  
Shaw, Secretary. May 8, 1909. \$500,000.  
One well, Fresno County.

**\*COALINGA NORTH POLE OIL COM-  
PANY,**

Box 692, Fresno, Cal. W. B. Holland,  
President. L. W. Wilson, Secretary.  
October 2, 1909. \$50,000. Fresno  
County.

**\*COALINGA PACIFIC OIL AND GAS  
COMPANY,**

607 First National Bank Bldg., San  
Francisco, Cal. Robert Hays Smith,  
President. A. Whearty, Secretary.  
August 4, 1903. \$165,000. Two wells,  
Fresno County.

**COALINGA PEERLESS OIL COMPANY,**

824 Crocker Bldg., San Francisco, Cal.  
Gordon Bradley, Assistant Secretary.  
(Property sold to Standard Oil Com-  
pany.)

**\*COALINGA PETROLEUM COMPANY,**

Coalinga, Cal. A. A. Baker, Secretary.  
January 23, 1905. \$75,000. Six wells,  
Fresno County.

**COALINGA SECURITY OIL COMPANY, THE,**

319 Investment Bldg., Los Angeles, Cal.  
F. E. Woodruff, President. C. H. McWilliams, Secretary. February 25, 1910. \$300,000. Fresno County (Property leased to Union Oil Company.)

**\*COALINGA STAR OIL COMPANY,**

1004 Security Bldg., Los Angeles, Cal.  
Thos. A. O'Donnell, President. Ellis T. Yarnell, Secretary. May 10, 1916. \$200,000. Eleven wells, Fresno County.

**\*COALINGA SYNDICATE OIL COMPANY,**

433 California St., San Francisco, Cal.  
H. U. Maxfield, President. A. E. Boynton, Secretary. June 28, 1911. \$2,500,000. Two wells, Fresno County.

**\*COALINGA UNITY OIL COMPANY,**

55 New Montgomery St., San Francisco, Cal.  
A. C. McLaughlin, President. P. G. Williams, Secretary. September 24, 1909. \$200,000. Four wells, Fresno County.

**COAST RANGE OIL COMPANY,**

701 Washington Bldg., Los Angeles, Cal.  
Mary B. Cates, President. Alton M. Cates, Secretary. May 10, 1890. \$1,000,000, Orig.; \$10,000, Dec. Fresno County.

**\*COHN & O'CONNOR,**

Fillmore, Cal. Five wells, Ventura County.

**COLONIA OIL COMPANY OF OXNARD, CALIFORNIA,**

Box A, Oxnard, Cal. A. Levy, President. R. W. Witman, Secretary. September 13, 1909. \$200,000.

**\*COLORADO OIL COMPANY,**

Care Merchants National Bank, San Diego, Cal. Ralph Granger, President. J. E. Hasbrouck, Secretary. December 22, 1909. \$200,000. Fourteen wells, Los Angeles County.

**COLORADO-PACIFIC DEVELOPMENT COMPANY,**

337 Deseret News Annex, Salt Lake City, Utah. J. H. Hunt, President. L. A. Maison, Secretary. December 5, 1907. \$1,000,000. (Dissolved.)

**\*COLUMBIA OIL PRODUCING COMPANY,**

303 Tajo Bldg., Los Angeles, Cal. W. B. Scott, President. W. Astley, Secretary. May 28, 1900. \$3,500,000. Sixty wells, Orange County; 44 wells, Los Angeles County.

**COLUMBUS MIDWAY OIL COMPANY,**

341 Montgomery St., San Francisco, Cal. January 18, 1910. \$1,000,000. (Revived by Secretary of State, September 18, 1918.)

**\*COMBINED OIL COMPANY, THE,**

1106 Hobart Bldg., San Francisco, Cal.  
Philip C. Boardman, President. George J. Hausen, Secretary. May 29, 1911. \$500,000. Seven wells, Kern County.

**\*COMMERCIAL PETROLEUM COMPANY,**

120 Market St., San Francisco, Cal.  
M. L. Woy, President. W. P. Roth, Secretary. July 27, 1896. \$250,000. Eight wells, Fresno County.

**COMSTOCK CRUDE OIL COMPANY,**

421 Kerckhoff Bldg., Los Angeles, Cal.  
L. N. Comstock, President. N. J. Hudson, Secretary. November 2, 1912. \$500,000.

**\*CONFIDENCE OIL COMPANY,**

Box 867, Fresno, Cal. D. S. Ewing, President. A. W. Burdick, Secretary. May 13, 1899. \$48,000. Seven wells, Fresno County.

**CONSERVATIVE DEVELOPMENT COMPANY,**

319 Wilcox Bldg., Los Angeles, Cal., care C. E. Price. L. W. Myers, President. C. E. Price, Secretary. February 27, 1903. \$200,000, Orig.; \$20,000, Dec.

**\*CONSERVATIVE OIL COMPANY,**

2223 Nineteenth St., Bakersfield, Cal.  
C. Brubacher, President. E. L. Schultz, Secretary. March 1, 1905. \$62,500. Two wells, Kern County.

**\*CONSOLIDATED MUTUAL OIL COMPANY,**

544 Market St., San Francisco, Cal.  
Louis Titus, President. C. F. Nance, Secretary. February 16, 1914. \$3,000,000. Fourteen wells, Kern County.

**CONSOLIDATED OIL AND DEVELOPMENT COMPANY,**

519 California St., San Francisco, Cal.  
Dr. L. M. F. Wanzer, President. H. L. Grunzburger, Secretary. August 14, 1896. \$50,000.

**\*CONSOLIDATED OIL LANDS COMPANY,**

433 California St., San Francisco, Cal.  
Chas. W. Gardner, President. A. E. Boynton, Secretary. April 27, 1911. \$5,000,000. Two wells, Fresno County.

**CONTINENTAL OIL AND MINERAL COMPANY,**

1055 Market St., San Francisco, Cal.  
M. Spiegelman, President. E. J. Long, Secretary. July 14, 1914. \$100,000. Santa Clara County. (Property now operated by Rhoads & Schmitt.)

**CONTINENTAL OIL COMPANY OF LOS ANGELES,**

Care C. E. Price, Wilcox Bldg., Los Angeles, Cal. A. D. Elwell, President. C. E. Price, Secretary. December 16, 1899. \$300,000.

**CONTINENTAL PETROLEUM COMPANY,**

Sharon Bldg., San Francisco, Cal. December 15, 1907. \$200,000.

**CONTRA COSTA OIL SYNDICATE,**

424 Phelan Bldg., San Francisco, Cal.  
R. R. Veale, President. B. Schapiro, Secretary. October 20, 1917. \$100,000.

- COPA DE ORO PETROLEUM COM- DAYTON OIL COMPANY OF OHIO,**  
**PANY,**  
 600 Chicago Ave., Riverside, Cal. K. D. Harger, President. H. D. French, Secretary. December 12, 1914. \$450,000.
- COPECK OIL COMPANY,**  
 310 Sansome St., San Francisco, Cal. John Barneson, President. J. Leslie Barneson, Secretary. January 8, 1909. \$500,000.
- COSMO OIL COMPANY,**  
 Box 267, Hanford, Cal. J. F. Brown, President. F. B. Cunningham, Secretary. April 29, 1909. \$100,000.
- \*COSMOPOLITAN OIL COMPANY,**  
 510 Douglas Bldg., Los Angeles, Cal. G. L. Holton, President. Robt. G. Holton, Secretary. May 1, 1912. \$400,000. Ventura County.
- CRAFTON OIL COMPANY,**  
 Mentone, Cal. J. R. Baird, Jr., President. A. R. Schultz, Secretary. February 17, 1911. \$25,000.
- CREE OIL COMPANY,**  
 617 Merritt Bldg., Los Angeles, Cal. Burton E. Green, President. F. B. Sutton, Secretary. June 1, 1903. \$5,000,000. Orig.; \$1,000,000. Dec.
- \*CRESCUS OIL COMPANY,**  
 579 H. W. Hellman Bldg., Los Angeles, Cal. P. E. Spellacy, President. M. Sands, Secretary. March 7, 1907. \$320,000. Kern County.
- CRESCENT PETROLEUM COMPANY,**  
 7 Webb Bldg., Coalinga, Cal. C. A. Hively, President. A. H. Panley, Secretary. February 29, 1916. \$50,000.
- \*CRITES, ARTHUR S. (Trustee),**  
 Bakersfield, Cal. Fifteen wells. Kern County. (Formerly Linda Vista Oil Company and Piedmont Oil Company.) (Dissolved.)
- CROWN OF THE VALLEY OIL COMPANY,**  
 Box 613, Pasadena, Cal. C. W. Rhodes, President. R. D. Badger, Secretary. March 2, 1900. \$300,000. Orange County.
- CROW OIL COMPANY,**  
 2726 Hillegass Ave., Berkeley, Cal. C. E. Crow, President. R. B. Marshall, Secretary. April 25, 1900. \$400,000.
- CUBBON OIL COMPANY,**  
 421 N. Main St., Santa Ana, Cal. John Cubbon, President. J. G. Quick, Secretary. September 24, 1900. \$200,000.
- \*DABNEY & COMPANY, JOSEPH B.,**  
 605 Union Oil Bldg., Los Angeles, Cal. Joseph Dabney, Owner. Seventeen wells. Kern County.
- DABNEY OIL COMPANY,**  
 1026 Marsh-Strong Bldg., Los Angeles, Cal. John R. Wilson, President. John S. Mitchell, Secretary. May 31, 1901. \$1,000,000. Kern County.
- DAVIS-McPHAILL OIL COMPANY,**  
 Care J. E. Davis, Trinity Hotel, Los Angeles, Cal.
- 371 W. First St., Dayton, Ohio. Geo. M. Smart, President. G. Frank Kuhno, Secretary. October 15, 1908. \$200,000. Kern County.
- \*DEL REY OIL COMPANY,**  
 Room 6, Union Savings Bank Bldg., Pasadena, Cal. Alex. Miller, President. John C. Dalton, Secretary. December 19, 1900. \$1,000,000. Nine wells. Kern County.
- DEL SABLE OIL COMPANY,**  
 530 Davis St., San Francisco, Cal. Louis Getz, President. Louis Nathan, Secretary. November 24, 1899. \$250,000.
- DELANEY OIL COMPANY, H. L.,**  
 Brea, Orange County, Cal., care Jay E. Sexton. January 25, 1918. \$100,000,000.
- DE LUXE OIL COMPANY,**  
 P. O. Box 867, Fresno, Cal. George Kaehler, President. A. W. Burdick, Secretary. December 2, 1908. \$100,000. (Dissolved.)
- \*DEVILS DEN CONSOLIDATED OIL COMPANY,**  
 510 Crocker Bldg., San Francisco, Cal. Geo. T. Cameron, President. R. A. Morton, Secretary. February 2, 1900. \$103,000. Twelve wells. Kern County.
- DEVILS DEN DEVELOPMENT COMPANY,**  
 Care A. H. Murray, Visalia, Cal. May 18, 1900. \$125,000.
- DIAMOND OIL COMPANY,**  
 201-202 Bradbury Bldg., Los Angeles, Cal. E. R. Kellam, President. E. H. Miller, Secretary. January 17, 1916. \$25,000.
- DIAMOND TIP OIL COMPANY,**  
 Reedley, Cal. G. A. Gallagher, President. Harry F. Winnes, Secretary. March, 26, 1910. \$12,000.
- \*DIAMOND VALLEY OIL COMPANY,**  
 626 S. Spring St., Los Angeles, Cal. Chas. M. Hoff, President. Melvin Bartlett, Secretary. February 3, 1911. \$1,000,000. One well. Ventura County.
- DIRECTORS OIL COMPANY,**  
 401 Union Oil Bldg., Los Angeles, Cal. E. R. Snyder, President. F. C. Lamb, Secretary. March 9, 1899. \$12,000.
- DIXIE OIL COMPANY,**  
 121 E. Main St., Visalia, Cal. A. Levis, President. Adolph D. Sweet, Secretary. February 3, 1900. \$100,000.
- \*D. J. OIL COMPANY,**  
 532 Fifteenth St., Oakland, Cal. C. A. Brown, President. E. R. Arner, Secretary. June 13, 1912. \$40,000. Three wells. Kern County; four wells. San Luis Obispo County. (Property sold to California Oil Company.)
- DOAN, WHITAKER & LAYMANCE,**  
 1432 Broadway, Oakland, Cal.
- \*DOHENY PACIFIC PETROLEUM COMPANY,**  
 1011 Security Bldg., Los Angeles, Cal. E. L. Doheny, President. E. L. Doheny, Jr., Secretary. August 15, 1917. \$5,000,000. Five wells. Kern County; 14 wells. Ventura County; 27 wells. Santa Barbara County.

- \*DOMINION OIL COMPANY,**  
21-23 Drumm St., San Francisco, Cal.  
W. J. Moore, President. A. J. Ranken,  
Secretary. January 20, 1910. \$250,000.  
Four wells, Kern County.
- DORAN OIL COMPANY, E. A.,**  
456 S. Spring St., Los Angeles, Cal.  
E. A. Doran, President. R. Tudor,  
Secretary. February 12, 1903. \$40,000.  
(Formerly Doran, Brouse & Price.)
- \*DUDLEY, B. B. & E. R.,**  
532 Fifteenth St., Oakland, Cal. Two  
wells, Kern County.
- DUDLEY OIL COMPANY,**  
261 California St., San Francisco, Cal.  
John C. IIs, President. William Kahn,  
Secretary. October 3, 1907. \$10,000.
- \*DUDLEY PETROLEUM COMPANY,  
B. B. & E. R.,**  
532 Fifteenth St., Oakland, Cal. E. R.  
Dudley, President. E. R. Arner, Sec-  
retary. March 11, 1914. \$2,000,000.  
Fifteen wells. (Property sold to the  
California Oil Company.)
- \*DUDLEY RANCH & ORCHARDS COM-  
PANY,**  
532 Fifteenth St., Oakland, Cal. Two  
wells, San Luis Obispo County, Cal.  
(Property sold to the California Oil  
Company.)
- \*DUNHAM, A. M.,**  
Box 44, Santa Paula, Cal. Three wells,  
Ventura County.
- \*DUNLOP OIL COMPANY,**  
1012 Hobart Bldg., San Francisco, Cal.  
Fred DeAugustine, President. A. B.  
Cast, Secretary. November 26, 1909.  
\$200,000. Ten wells, Kern County.
- EAGLE HILL OIL COMPANY,**  
532 I. W. Hellman Bldg., Los Angeles,  
Cal. Chas. Kestner, President. E. V.  
T. Sens, Secretary. December 29,  
1916. \$100,000.
- EAGLET OIL COMPANY,**  
255 Holbrook Bldg., San Francisco, Cal.  
J. A. Weston, President. S. G. O.  
King, Secretary. February 27, 1901.  
\$300,000. Orig.; \$50,000, Dec. Kern  
County.
- EAST OAKLAND OIL COMPANY,**  
2322 E. Fifteenth St., Oakland, Cal.  
J. J. Enos, President. H. A. Bill,  
Secretary. August 28, 1908. \$10,000.
- EAST PUENTE ANNEX OIL COMPANY,**  
412 Bumiller Bldg., Los Angeles, Cal.  
A. L. Ellis, Vice President. July 17,  
1916. \$100,000.
- \*EAST PUENTE OIL COMPANY,**  
208 Granger Block, San Diego, Cal. Geo.  
R. Harrison, President. Geo. R.  
Rogers, Secretary. March 25, 1901.  
\$500,000. Twenty-four wells, Kern  
County.
- EAST SAN EMIDIO OIL LAND COM-  
PANY,**  
347 Title Insurance Bldg., Los Angeles,  
Cal. Chas. A. Cole, President. W. S.  
McGiffert, Secretary. April 20, 1911.  
\$50,000.
- EAST WHITTIER OIL COMPANY,**  
404 H. W. Hellman Bldg., Los Angeles,  
Cal. W. W. Neuer, President. Robt.  
N. Bulla, Secretary. May 21, 1900.  
\$250,000.
- ECHO BREA OIL COMPANY,**  
532 I. W. Hellman Bldg., Los Angeles,  
Cal. A. C. Labrie, President. E. V.  
T. Sens, Secretary. October 16, 1912.  
\$100,000.
- \*EDMONDS MIDWAY OIL COMPANY,**  
406 Wilcox Bldg., Los Angeles, Cal.  
A. B. Barret, President. C. P. Camp-  
bell, Secretary. May 27, 1910. \$1,500,-  
000. Two wells, Kern County.
- EIGHT OIL COMPANY, THE,**  
P. O. Box 90, Bakersfield, Cal. S. P.  
Wible, President. T. E. Klipstein,  
Secretary. March 22, 1909. \$50,000.
- ELAINE OIL COMPANY,**  
Box 207, Coalinga, Cal. Arthur Webb,  
President. Clara E. Webb, Secretary.  
March 7, 1907. \$300,000.
- \*EL CAMINO OIL & DEVELOPMENT  
COMPANY,**  
228 First National Bank Bldg., Oakland,  
Cal. W. V. Harrington, President.  
A. W. Beam, Secretary. October 26,  
1910. \$600,000. Five wells, Kern  
County.
- ELDEE OIL COMPANY,**  
Room 637, Holbrook Bldg., 58 Sutter St.,  
San Francisco, Cal. Chas. G. Wilcox,  
President. Louis Nathan, Secretary.  
September 15, 1908. \$500,000.
- \*EL DORA OIL COMPANY,**  
Box 352, Bakersfield, Cal. One well,  
Kern County.
- \*EL DORADO OIL COMPANY,**  
597 Monadnock Bldg., San Francisco,  
Cal. W. J. Berry, President. J. R.  
Murphy, Secretary. March 4, 1889.  
\$100,000. Five wells, Kern County.
- ELECTRA OIL COMPANY,**  
Room 637, Holbrook Bldg., 58 Sutter St.,  
San Francisco, Cal. Chas. G. Wilcox,  
President. Louis Nathan, Secretary.  
November 20, 1908. \$500,000.
- \*ELIM OIL COMPANY,**  
Union Oil Bldg., Los Angeles, Cal. J. P.  
Welles, President. L. M. Stewart,  
Secretary. September 12, 1912. \$50,000.  
Ventura County.
- \*ELK HORN OIL COMPANY,**  
Box 8, Taft, Cal. R. E. Graham, Presi-  
dent. G. G. Patton, Secretary. March  
13, 1908. \$300,000. Three wells, Kern  
County.
- ELK RIDGE OIL COMPANY,**  
903 Grattan St., Los Angeles, Cal.  
March 17, 1910. \$10,000.
- \*ELLIOTT OIL COMPANY,**  
310 Sansome St., San Francisco, Cal.  
Virgil F. Shaw, Secretary. One well,  
Kern County. (Formerly Elliott  
Lease.)
- ELSINORE AND TEMESCAL OIL AND  
LAND COMPANY,**  
304 Bryson Bldg., Los Angeles, Cal.  
Care Ben White. November 10, 1913.  
\$100,000.
- \*EMPIRE GAS AND FUEL COMPANY,**  
410 Brower Bldg., Bakersfield, Cal.  
R. A. Broomfield, President. E. C.  
Reed, Secretary. October 9, 1912.  
\$100,000. One well, Kern County.

**EMPIRE OIL COMPANY,**

1118 Hearst Bldg., San Francisco, Cal.  
H. A. Whitley, President. B. H. Henderson, Secretary. February 4, 1909.  
\$2,000. (Dissolved.)

**\*EMPIRE OIL COMPANY,**

637 Consolidated Realty Bldg., Los Angeles, Cal. A. I. Smith, Manager.  
Five wells, Ventura County. (Co-partnership.)

**ENCINAL OIL COMPANY,**

414 Marsh-Strong Bldg., Los Angeles, Cal. E. S. Shattuck, President. Wm. J. Nimmo, Secretary. May 2, 1907.  
\$1,000,000.

**\*ENGINEERS OIL COMPANY,**

519-21 Consolidated Realty Bldg., Los Angeles, Cal. F. C. Kingsbury, President. C. M. Dull, Secretary. March 28, 1911. \$220,000. Seven wells, Kern County.

**\*ENOS OIL COMPANY,**

278 Russ Bldg., San Francisco, Cal. Jno. Baker, Jr., President. I. Sutcliffe, Secretary. May 1, 1909. \$500,000. Six wells, Kern County.

**ENSIGN OIL COMPANY,**

284 Perry St., San Francisco, Cal. E. J. Ensign, President. May 13, 1914.  
\$100,000.

**ENTERPRISE LAND AND OIL COMPANY,**

58 Sutter St., San Francisco, Cal. J. Goldman, Treasurer-Superintendent. November 7, 1899. \$200,000.

**EQUITABLE PETROLEUM COMPANY,**

1029 Title Insurance Bldg., Los Angeles, Cal. James Shultz, President. Donald Baker, Secretary. October 3, 1908.  
\$100,000. Kern County.

**\*ETHEL D. COMPANY,**

597 Monadnock Bldg., San Francisco, Cal. C. J. Berry, President. D. S. Ewing, Secretary. September 13, 1909.  
\$1,000,000. Twenty-five wells, Kern County.

**ETZENHAUSER OIL COMPANY,**

300 E. Main St., Visalia, Cal. L. Lucier, President. J. Sub Johnson, Secretary. October 13, 1909. \$75,000.

**\*EUCLID OIL COMPANY,**

619 Union Oil Bldg., Los Angeles, Cal. M. V. McQuigg, President. A. J. Wallace, Secretary. August 8, 1900.  
\$350,000. Seven wells, Kern County.

**\*EUREKA CRUDE OIL COMPANY,**

1037 N. Alameda St., Los Angeles, Cal. E. A. Clappitt, President. Henry A. Greene, Secretary. December 26, 1916.  
\$10,000. Two wells, Los Angeles County.

**EXPLORATION OIL COMPANY,**

201 Sansome St., San Francisco, Cal. Dorsey Ash, President. Walter Loewy, Secretary. March 25, 1909. \$200,000, Orig.; \$400,000, Inc.

**EXTENSION OIL COMPANY,**

418 Chamber of Commerce Bldg., Los Angeles, Cal. Julius Fried, President. W. W. Worthing, Secretary. April 13, 1910. \$1,000,000. Kern County.

**\*FAIRBANKS OIL COMPANY,**

2108 Shattuck Ave., Berkeley, Cal. James R. Little, President. Robt. H. Whetmore, Secretary. December 9, 1907. \$25,000, Orig.; \$50,000, Inc. Twelve wells, Kern County.

**FAIRFIELD PETROLEUM COMPANY,**

1015 Security Bldg., Los Angeles, Cal. E. L. Doheny, Jr., President. O. D. Bennett, Secretary. April 10, 1916.  
\$10,000.

**FAITHFUL OIL COMPANY,**

1416 Nineteenth St., Bakersfield, Cal. Chas. E. Lee, Vice President. A. Weill, Secretary. May 20, 1909.  
\$25,000.

**FAR WEST COMPANY,**

1114 Union Oil Bldg., Los Angeles, Cal. D. T. Perkins, President. W. L. Stewart, Secretary. June 1, 1891.  
\$50,000. (Formerly Far West Oil Company.)

**FEDERAL OIL SYNDICATE, THE,**

Care C. W. Morris, 506 Chronicle Bldg., San Francisco, Cal. June 1, 1918.  
\$1,000,000.

**\*FETHER, F. A.,**

Box 125, R. F. D. No. 5, Bakersfield, Cal. Nine wells, Kern County.

**\*FIVE STAR OIL COMPANY, INC.,**

518 Investment Bldg., Los Angeles, Cal. December 17, 1909. \$100,000. (See Cheney Stimson Oil Company.)

**FIVE THIRTY-SIX OIL COMPANY,**

1047 Monadnock Bldg., San Francisco, Cal. Chester L. Hovey, President. A. E. Bolton, Secretary. June 6, 1907.  
\$100,000. Kern County.

**F. M. J. OIL COMPANY,**

Box 115, Bakersfield, Cal. J. W. Briscoe, President. J. A. Hughes, Secretary. April 27, 1911. \$25,000.

**FORT WAYNE CALIFORNIA OIL COMPANY,**

510 S. Los Robles Ave., Pasadena, Cal. W. J. Randall, President. Chas. Pfeiffer, Secretary. September 30, 1908. \$300,000. Kern County.

**\*4 OIL COMPANY,**

507 Foxcroft Bldg., San Francisco, Cal. Wm. E. Miles, President. A. J. Weston, Secretary. April 19, 1900.  
\$30,000. Twelve wells, Kern County.

**\*FOX & GARRETT OIL COMPANY,**

R. F. D. No. 5, Bakersfield, Cal. G. S. Butler, President. R. L. Burdic, Secretary. January 3, 1910. \$150,000. Two wells, Kern County.

**FOX OIL COMPANY,**

H St. and Ocean Ave., Lompoc, Cal. A. Lehmann, President. E. L. Walley, Secretary. November 12, 1909.  
\$440,000. Kern County.

**FRESNO MIDWAY LAND AND OIL COMPANY,**

County Auditor's Office, Fresno, Cal. Care of S. L. Hogue, Secretary. L. Samuels, President. February 17, 1908.  
\$25,000.

- \*FULLERTON GREAT WEST OIL COMPANY,**  
213 Owl Drug Bldg., San Diego, Cal.  
A. J. Bradley, President. W. E. Hinkle, Secretary. March 6, 1914. \$500,000. Two wells, Orange County.
- \*FULLERTON OIL COMPANY,**  
Box 34, Fullerton, Cal. W. L. Valentine, President. H. M. Marple, Secretary. February 26, 1907. \$600,000. Two wells, Los Angeles County; 19 wells, Orange County.
- FULLERTON OIL COMPANY (LOS ANGELES),**  
1124 Merchants National Bank Bldg., Los Angeles. W. L. Valentine, President. H. M. Marple, Secretary. May 8, 1899. \$25,000.
- FULTON FUEL AND ROAD OIL COMPANY,**  
Care A. J. Coogan, 904 Merchants Exchange Bldg., San Francisco, Cal. John B. Wandell, President. Herbert N. Leach, Secretary. January 17, 1912. \$400,000. (Operated by Melita Oil Company.)
- FUTURE SUCCESS OIL COMPANY,**  
Coalinga, Cal. R. Baker, President. A. A. Baker, Secretary. May 3, 1913. \$100,000.
- GADDIE OIL DEVELOPMENT COMPANY,**  
Care G. E. Delevan, Jr., 521 Washington Bldg., Los Angeles, Cal. December 11, 1918. \$25,000.
- \*GARBUIT OIL COMPANY,**  
914 Merchants National Bank Bldg., Los Angeles, Cal. Frank A. Garbutt, President. Moye W. Stephens, Secretary. November 1, 1907. \$500,000. Two wells, Los Angeles, Cal.
- GARNER MADISON OIL COMPANY,**  
1025 Citizens National Bank Bldg., Los Angeles, Cal. Care Ben. S. Hunter, Secretary. A. J. Garner, President. January 11, 1918. \$75,000.
- GATO RIDGE OIL COMPANY,**  
433 California St., San Francisco, Cal. Chas. W. Gardner, President. A. E. Boynton, Secretary. June 18, 1910. \$1,000,000.
- GENERAL PETROLEUM COMPANY,**  
1003 Higgins Bldg., Los Angeles, Cal. John Barneson, President. C. R. Stevens, Secretary. March 30, 1910. \$50,000,000.
- \*GENERAL PETROLEUM CORPORATION,**  
1003 Higgins Bldg., Los Angeles, Cal. John Barneson, President. C. R. Stevens, Secretary. May 25, 1916. \$16,702,400. Sixteen wells, Fresno County; 308 wells, Kern County; 37 wells, Orange County.
- \*A. F. GILMORE COMPANY,**  
700 Van Nuys Bldg., Los Angeles, Cal. E. B. Gilmore, Manager and Secretary. February 3, 1915. \$50,000. Eighteen wells, Los Angeles County.
- GILMORE PETROLEUM COMPANY,**  
700 Van Nuys Bldg., Los Angeles, Cal. June 15, 1918. \$25,000.
- \*GILROY OIL COMPANY,**  
522 Security Bldg., Los Angeles, Cal. S. C. Graham, President. S. E. Brobst, Secretary. Eight wells, Santa Cruz County. (Dissolved.)
- GLACIER PETROLEUM COMPANY,**  
501 Investment Bldg., Los Angeles, Cal. Claud B. Andrews, President. Lester M. Gray, Secretary. June 28, 1917. \$9,600.
- GLOBE OIL COMPANY,**  
619 Union Oil Bldg., Los Angeles, Cal. M. V. McQuigg, President. A. J. Wallace, Secretary. April 11, 1906. \$600,000. Kern County.
- GOLDEN STATE OIL COMPANY,**  
2334 E. Twenty-seventh St., Los Angeles, Cal. S. A. Thompson, President. J. O. Haley, Secretary. December 16, 1915. \$50,000.
- GOLD SEAL PETROLEUM COMPANY,**  
1005 Haas Bldg., Los Angeles, Cal. John Rome, President. O. Park Smith, Secretary. January 19, 1915. \$450,000.
- GOOD HOPE WELLS,**  
814 Merchants National Bank Bldg., Los Angeles, Cal.
- \*GOOD LUCK OIL COMPANY,**  
948 Market St., San Francisco, Cal. James Madison, President. Albert Albrecht, Secretary. January 17, 1905. \$100,000. Five wells, Fresno County.
- \*GOOD ROADS OIL COMPANY,**  
208 Brower Bldg., Bakersfield, Cal. W. H. Hill, President. C. A. Barlow, Secretary. January 5, 1914. \$50,000. Eight wells, Kern County.
- GRADOR OIL COMPANY,**  
12 South Fair Oaks Ave., Pasadena, Cal. S. C. Graham, President. Arthur N. Gage, Secretary. August 16, 1908. \$250,000.
- GRAHAM-LOFTUS OIL COMPANY,**  
Santa Paula, Cal. Wm. Loftus, President. Allan C. McKevitt, Secretary. December 19, 1898. \$40,000, Orig.; \$1,000,000, Inc. Orange County.
- \*J. E. GRAY ESTATE,**  
Box 263, Bakersfield, Cal. Twenty-eight wells, Kern County.
- \*J. E. GRAY OIL COMPANY,**  
P. O. Box 263, Bakersfield, Cal. S. A. Gray, President. G. W. Gray, Secretary. January 13, 1903. \$100,000. Twenty-six wells, Kern County.
- GREAT REPUBLIC OIL AND PAINT COMPANY,**  
619 Brockman Bldg., Los Angeles, Cal. M. F. Tufts, Secretary. January 21, 1915. \$250,000. (Revived by Controller May 9, 1917.)
- \*GUARDIAN OIL COMPANY,**  
343 Sansome St., San Francisco, Cal. H. H. Beers, President. R. A. Lewin, Secretary. March 20, 1915. \$500,000. Twelve wells, Fresno County.
- GUTHREY OIL COMPANY,**  
1001 Insurance Exchange, San Francisco, Cal. G. W. McNear, Jr., President. J. P. Rothwell, Secretary. January 5, 1906. \$150,000.

**\*HALE-MCLEOD OIL COMPANY,**

518 Investment Bldg., Los Angeles, Cal.  
Nathan W. Hale, President. F. V. Gordon, Secretary. September 29, 1909. Fifteen wells, Kern County.

**HALE SYNDICATE,**

Troy Owens, Owner. Fellows, Cal. (Wildcat well near McFarland.)

**HAMILTON OIL AND GAS COMPANY OF LOS ANGELES,**

El Centro, Cal. December 28, 1908. \$100,000.

**HANFORD DEVIL'S DEN OIL COMPANY,**

Care Hanford Water Co., Hanford, Cal. May 1, 1917. \$75,000.

**\*HANFORD-SANGER OIL COMPANY,**

514 I. W. Hellman Bldg., Los Angeles, Cal. F. R. Dunlap, President. H. E. Woods, Secretary. January 31, 1901. \$300,000. Four wells, Kern County. (Dissolved.)

**HARBOR CRUDE OIL COMPANY,**

911 Investment Bldg., Los Angeles, Cal. W. F. Young, President. C. W. DeFreest, Secretary. July 3, 1913. \$1,000,000.

**HARLIND OIL COMPANY,**

Room 1402 Humboldt Bank Bldg., San Francisco, Cal. Chas. M. Lindsay, President. S. N. Norton, Secretary. January 27, 1910. \$250,000. Kern County.

**HARRIS & CATES (See C. B. Cates Co.),**

701 College St., Los Angeles, Cal. (Operating Strong Oil Lease and Arizona Petroleum Lease June to September, 1918.)

**\*HARRIS AND STEVENS CORPORATION,**

926 Black Bldg., Los Angeles, Cal. C. C. Harris, President. C. P. E. Menzies, Secretary. March 19, 1914. \$75,000. Fourteen wells, Kern County.

**\*C. C. HARRIS OIL COMPANY,**

701 College St., Los Angeles, Cal. Mary B. Cates, President. E. R. Snyder, Secretary. February 10, 1909. \$500,000. One hundred and thirty-five wells, Los Angeles City Field.

**HART PAYNE COMPANY,**

Maricopa, Cal.

**HARTER OIL COMPANY,**

322 Stimson Bldg., Third and Spring Sts., Los Angeles, Cal. Pavan F. Rice, President. E. Roberts, Secretary. September 22, 1900. \$250,000.

**HAUHUTH OIL COMPANY,**

Vallejo, Cal. Wm. Hauhuth, President. Minnie McPherson, Secretary. November 17, 1916. \$50,000.

**HAVILAND CRUDE OIL COMPANY,**

416 Pacific Electric Bldg., Los Angeles, Cal. Care S. J. White. March 11, 1908. \$25,000.

**HAWAIIAN OIL COMPANY,**

120 Market St., San Francisco, Cal. W. P. Roth, Secretary. June 28, 1909. \$250,000. Kern County.

**HAYES, H. L.,**

Ventura, Cal.

**HAZELTON CRUDE OIL COMPANY,**

Bakersfield, Cal. J. W. Kelly, President. Ida M. Kelly, Secretary. November 23, 1908. \$25,000.

**HEARD & PAINTER COMPANY,**

Taft, Cal. J. W. Heard, President. Emma C. Heard, Secretary.

**HENDERSON OIL COMPANY,**

922 Kohl Bldg., San Francisco, Cal. Benj. Bangs, President. Thomas C. Berry, Secretary. June 19, 1908. \$500,000. Santa Barbara County.

**\*HENDERSON UNION OIL COMPANY,**

724 S. Main St., Los Angeles, Cal. E. E. Henderson, President. W. F. Wilson, Secretary. March 20, 1911. \$100,000. Four wells, Ventura County.

**HENRIETTA OIL COMPANY,**

824 Mills Bldg., San Francisco, Cal. Oliver Ellsworth, President. M. A. Thomas, Secretary. October 2, 1900. \$200,000. Kern County.

**HICKLER OIL COMPANY,**

404 S. Raymond Ave., Pasadena, Cal. W. I. Hollingsworth, President. W. H. Smidden, Secretary. February 28, 1901. \$200,000.

**HIDALGO OIL COMPANY,**

307 Insurance Bldg., San Francisco, Cal. F. B. Chapin, President. C. H. Sherman, Secretary. July 19, 1913. \$100,000.

**HIGHLAND DEVELOPMENT COMPANY,**

959 E. Fourth St., Los Angeles, Cal. Jos. F. Stevens, President. L. J. Link, Secretary. December 29, 1915. \$10,000.

**HIGHLAND OIL COMPANY,**

Care L. L. Cory, Fresno, Cal. L. L. Cory, President. E. Owen, Secretary. October 13, 1899. \$200,000.

**HILLCREST OIL COMPANY,**

Howard Canfield Bldg., Santa Barbara, Cal. E. H. Sawyer, President. A. R. Edmondson, Secretary. May 2, 1910. \$500,000.

**HILL TOP OIL COMPANY,**

Box 98, Santa Paula, Cal. I. B. Martin, President. April 21, 1909. \$100,000.

**\*HOME OIL COMPANY,**

P. O. Box 33, Whittier, Cal. L. Butman, President. Alva Starbuck, Secretary. June 19, 1897. \$100,000. Thirteen wells, Los Angeles County.

**\*HOME RANCH PETROLEUM COMPANY,**

923 I. N. Van Nuys Bldg., Los Angeles, Cal. S. A. Guiberson, Jr., President. O. D. Bennett, Secretary. January 12, 1917. \$200,000. One well, Ventura County.

**\*HOMESTEAD DEVELOPMENT COMPANY,**

433 California St., San Francisco, Cal. Chas. W. Gardner, President. A. E. Boynton, Secretary. May 29, 1911. \$500,000. Twelve wells, Fresno County.

**\*HONDO OIL COMPANY,**

617 Merritt Bldg., Los Angeles, Cal.  
M. L. Whittier, President. H. L.  
Westbrook, Secretary. July 19, 1916.  
\$100,000. Fifteen wells, Kern County.

**\*HONOLULU CONSOLIDATED OIL COMPANY,**

120 Market St., San Francisco, Cal.  
A. C. Dierickx, President. W. P. Roth,  
Secretary. April 19, 1910. \$5,000,000.  
Forty wells, Kern County.

**HOPKINS OIL COMPANY,**

Santa Maria, Cal. W. A. Haslam, Presi-  
dent. Geo. Black, Secretary. July 15,  
1907. \$75,000.

**HUMAUMA OIL COMPANY,**

310 Sansome St., San Francisco, Cal.  
Harry B. Gregg, Vice President. F.  
Klamp, Secretary. April 16, 1910.  
\$1,000,000.

**HURLEY STONE COMPANY,**

Consolidated Realty Bldg., Los Angeles,  
Cal. Kern County. (Co-partnership.)

**HUTCHINSON PETROLEUM CORPORATION,**

303 International Bank Bldg., Los An-  
geles, Cal. Care Roger Marchetti.  
November 13, 1916. \$10,000.

**IBEX OIL COMPANY,**

701 College St., Los Angeles, Cal. Mary  
B. Cates, President. E. R. Snyder,  
Secretary. August 25, 1908. \$10,000.

**\*IDA MAY OIL COMPANY,**

Box 58, Maricopa, Cal. Arthur Brand,  
Secretary. (Woods & Hansen, oper-  
ators) Kern County.

**IDEAL OIL COMPANY,**

1028 Chorro St., San Luis Obispo, Cal.  
Care P. A. H. Arata. July 15, 1907.  
\$50,000.

**\*ILLINOIS CRUDE OIL COMPANY,**

Box 168, R F D No. 1, Bakersfield, Cal.  
T. V. Doub, President. C. E. Arnold,  
Secretary. July 12, 1901. \$200,000.  
Nine wells, Kern County.

**IMPERIAL OIL COMPANY,**

350 Mills Bldg., San Francisco, Cal.  
J. J. Mack, President. H. Steinbach,  
Secretary. August 14, 1899. \$100,000.

**\*INCA OIL COMPANY,**

245 Holbrook Bldg., San Francisco, Cal.  
Burton E. Green, President. M. B.  
Downing, Secretary. February 26,  
1904. \$100,000 Orig.; \$750,000 Inc.  
Thirty-four wells, Fresno County.

**\*INDIAN AND COLONIAL DEVELOPMENT COMPANY, LIMITED, THE,**

Taft, Cal. Arthur Farish, President.  
Ernest Jackson, Secretary. December  
22, 1911. \$1,000. Twenty wells, Kern  
County.

**INDIAN VALLEY OIL COMPANY,**

San Miguel, Cal. J. T. Densmore, Presi-  
dent. E. Bergemann, Secretary. April  
22, 1909. \$50,000. (Dissolved.)

**\*INTERSTATE OIL COMPANY,**

1010 Wright & Callender Bldg., Los An-  
geles, Cal. D. W. Wickersham, Presi-  
dent. Floyd G. White, Secretary.  
November 14, 1913. \$200,000. Six wells,  
Kern County.

**INVESTMENT DEVELOPMENT COM-  
PANY, THE,**

406 Insurance Exchange Bldg., San  
Francisco, Cal. Samuel Pond, Presi-  
dent. Albert Meyer, Secretary. Jan-  
uary 3, 1911. \$100,000.

**INVESTMENT OIL COMPANY,**

406 Insurance Exchange Bldg., San  
Francisco, Cal. S. H. Morsehead,  
President. Samuel Pond, Secretary.  
July 20, 1899. \$500,000.

**INVINCIBLE DEVELOPMENT COM-  
PANY,**

Care Fred Seulberger, Secretary. 418  
Fourteenth St., Oakland, Cal. Geo.  
Roeth, President. January 15, 1900.  
\$500,000 Orig.; \$50,000 Dec.

**IOWA OIL COMPANY,**

109 N. Greenleaf, Whittier, Cal. Sep-  
tember 7, 1900. \$200,000.

**JOHN IRWIN OIL COMPANY,**

Hueneme, Ventura County, Cal. E. O.  
Gerberding, Secretary. May 10, 1893.  
\$30,000.

**IVERS, J. C.,**

Fillmore, Cal. One well, Ventura  
County.

**\*J. M. S. OIL COMPANY,**

310 Sansome St., San Francisco, Cal.  
Virgil F. Shaw, Secretary. Six wells,  
Kern County.

**\*JACKSON OIL COMPANY,**

Reward, Kern County, Cal. S. P. Wible,  
President. D. A. Jackson, Secretary.  
October 18, 1907. \$50,000. Ten wells,  
Kern County.

**JADE OIL COMPANY, THE,**

1008 Security Bldg., Los Angeles, Cal.  
R. B. Williamson, President. Geo. L.  
Reynolds, Secretary. October 16, 1908.  
\$1,000,000. Kern County. (Property  
leased to Empire Gas & Fuel Com-  
pany and J. A. Lydell.)

**\*JEFFERSON OIL COMPANY,**

Care L. L. Richard, Owner. Coalinga,  
Cal. Two wells, Fresno County.

**JESSE YARNELL COMPANY,**

134 S. Bonnie Brae St., Los Angeles, Cal.  
Susan C. Yarnell, President. Cath-  
erine Yarnell, Secretary. April 8, 1907.  
\$40,000.

**\*JEWETT OIL COMPANY,**

Box 205, Bakersfield, Cal. Philo L.  
Jewett, President. A. Weill, Secre-  
tary. August 25, 1900. \$500,000. Ten  
wells, Kern County.

**JOHNSON OIL COMPANY,**

P. O. Box 1083, Fresno, Cal. E. Schwarz,  
President. R. D. Marshall, Secretary.  
December 4, 1908. \$100,000.

**JORDAN CRUDE OIL COMPANY,**

Box 193, Arcade Station, Los Angeles,  
Cal. James T. Jordan, President.  
One well, Los Angeles County. (Wild-  
cat.)

**JORDAN OIL COMPANY,**

Box 193, Arcade Station, Los Angeles,  
Cal. James T. Jordan, President.  
Ralph Martin, Secretary. May 25,  
1907. \$100,000.

**JOSEPHINE OIL COMPANY,**

1106 Investment Bldg., Los Angeles, Cal.  
J. M. Kent, President. E. A. Fano,  
Secretary. July 24, 1916. \$25,000.

**JUDSON OIL COMPANY,**

305 Hibernian Bldg., Los Angeles, Cal.  
March 15, 1909. \$250,000.

**\*JUNCTION OIL COMPANY,**

58 Sutter St., San Francisco, Cal. J.  
Goldman, President. S. G. O. King,  
Secretary. February 7, 1900. \$250,000.  
Eleven wells, Kern County.

**JUNE OIL COMPANY,**

428 Exchange Bldg., Los Angeles, Cal.  
Care A. C. Routh. March 15, 1918.  
\$300,000.

**KAISER OIL COMPANY,**

1114 Union Oil Bldg., Los Angeles, Cal.  
W. W. Orcutt, President. John Mc-  
Peak, Secretary. March 8, 1909.  
\$100,000. Santa Barbara County.  
(Dissolved.)

**K. AND V. OIL COMPANY,**

P. O. Box 482, Visalia, Cal. Susman  
Mitchell, President. A. Q. Beals, Sec-  
retary. March 1, 1909. \$100,000.

**\*KANSAS CRUDE OIL COMPANY,**

Care F. L. Sawyer, Independence, Kan-  
sas. One well, Los Angeles County.

**KAWAHE OIL DEVELOPMENT COM-  
PANY,**

P. O. Box 482, Visalia, Cal. H. A. Scott,  
President. A. Q. Beals, Secretary.  
March 22, 1909. \$100,000.

**KEELER & TAUSSIG,**

Citizens National Bank Bldg., Los An-  
geles, Cal.

**KEITH AND MACK OIL COMPANY,**

350 Mills Bldg., San Francisco, Cal. A.  
Mack, President. H. Steinbach, Sec-  
retary. December 4, 1907. \$20,000.

**KEITH OIL AND LAND COMPANY,**

350 Mills Bldg., San Francisco, Cal. A.  
Mack, President. H. Steinbach, Sec-  
retary. November 8, 1900. \$200,000.

**KELLOGG OIL COMPANY,**

933 Van Nuys Bldg., Los Angeles, Cal.  
F. R. Kellogg, President. G. J. Sym-  
inton, Secretary. December 9, 1910.  
\$50,000.

**KERN CAÑON OIL COMPANY,**

P. O. Box 235, Fresno, Cal. S. A. La-  
Rue, President. F. L. Simons, Secre-  
tary. March 6, 1900. \$75,000. Kern  
County.

**KERN CENTRAL OIL COMPANY,**

Room 1012 Mills Bldg., San Francisco,  
Cal. J. W. McCaughey, Secretary.  
December 21, 1899. \$100,000.

**\*KERN CROWN OIL COMPANY,**

Box 315, Taft, Cal. Catherine Suther-  
land, President. Hazel Benson, Secre-  
tary. December 20, 1915. \$20,000.  
Three wells, Kern County.

**\*KERN FOUR OIL COMPANY,**

519-21 Consolidated Realty Bldg., Los  
Angeles, Cal. F. C. Kingsbury, Presi-  
dent. C. M. Dull, Secretary. May 26,  
1909. \$100,000. Twenty-two wells,  
Kern County.

**KERN PETROLEUM COMPANY,**

509 Second St., Eureka, Cal. F. M.  
Downing, President. J. D. Girard,  
Secretary. February 17, 1910. \$250,000.

**KERN PUCHEU OIL COMPANY,**

2033 Mariposa St., Fresno, Cal. E. E.  
Slater, President. John Oed, Secre-  
tary. February 27, 1913. \$200,000.

**KERN RIVER DRILLERS OIL COM-  
PANY,**

1106 Investment Bldg., Los Angeles, Cal.  
J. M. Kent, President. E. T. Grady,  
Secretary. March 3, 1909. \$100,000.  
Kern County.

**\*KERN RIVER OIL COMPANY,**

238 Merchants Exchange Bldg., San  
Francisco, Cal. H. A. Voorman, Presi-  
dent. E. C. Landis, Secretary. June  
29, 1899. \$100,000. Kern County.

**\*KERN RIVER OILFIELDS OF CALI-  
FORNIA, LIMITED, THE,**

1117 Investment Bldg., Los Angeles, Cal.  
Wm. Ivey, President. Reginald H.  
Young, Secretary. July 6, 1910. \$2-  
908,325. Two hundred fifty-six wells,  
Kern County.

**KERN SUNSET OIL COMPANY,**

Maricopa Bank Bldg., Maricopa, Cal.  
E. A. Bear, President. Walter Snook,  
Secretary. March 27, 1908. \$100,000  
Orig.; \$10,000 Dec.

**KINGS RIVER OIL COMPANY,**

R. F. D. B, Box 1076, Fresno, Cal. Bur-  
ton Elwood, President. Mrs. J. C.  
Marlar, Secretary. June 5, 1899.  
\$100,000.

**\*KNICKERBOCKER OIL COMPANY,**

60 California St., San Francisco, Cal.  
J. D. Spreckels, Jr., President. G. E.  
Waterman, Secretary. March 15, 1911.  
\$400,000. Kern County.

**\*KNOB HILL OIL COMPANY,**

201 Cory Bldg., Fresno, Cal. James  
Porteous, President. W. J. Kittrell,  
Secretary. August 6, 1900. \$25,000.  
Thirty-three wells, Kern County.

**KOPJE OIL COMPANY,**

Box 1306, Fresno, Cal. Geo. S. Water-  
man, President. M. M. Dearing, Sec-  
retary. January 4, 1901. \$100,000.

**KRAMER CONSOLIDATED OIL COM-  
PANY,**

403 Germain Bldg., 224 S. Spring St.,  
Los Angeles, Cal. J. J. Morris, Presi-  
dent. D. F. Wilson, Secretary. No-  
vember 2, 1900. \$150,000 Orig.; \$600,000  
Inc.

**KRAMER MODEL OIL COMPANY,**

Room 403 Germain Bldg., 224 S. Spring  
St., Los Angeles, Cal. Lester S.  
Moore, President. Chas. T. Merritt,  
Secretary. April 29, 1910. \$21,000.

**LA BELLE OIL COMPANY,**

714 Central Bldg., Los Angeles, Cal.  
W. P. Cunningham, President. Stone  
Hastain, Secretary. March 5, 1909.  
\$100,000.

**\*LA BLANC OIL COMPANY, THE,**

228 First National Bank Bldg., Oakland,  
Cal. J. C. Downey, President. W. V.  
Harrington, Secretary. October 1, 1908.  
\$250,000. Two wells, Kern County.

**\*LABONGE, R. F.,**

Kentuck Lease, Fillmore, Cal. Three  
wells, Ventura County.

**LACEY OIL COMPANY,**

First National Bank, Hanford, Cal. J.  
E. Hall, President. R. V. Hall, Secre-  
tary. November 1, 1909. \$500,000.

**LA CORONA OIL AND ASPHALT COMPANY,**

1809 Chester Ave., Bakersfield, Cal. L. V. Olcese, President. J. B. Hewitt, Secretary. October 8, 1897. \$19,000.

**LAGUNA OIL COMPANY,**

Front and K Sts., Sacramento, Cal. Henry Mitau, President. G. W. Pel-tier, Secretary. April 19, 1917. \$50,000.

**LA HABRA OIL COMPANY,**

119 E. Colorado St., Pasadena, Cal. L. P. Hansen, President. Leo G. MacLaughlin, Secretary. April 6, 1910. \$500,000.

**\*LAKEPORT PETROLEUM COMPANY,**

Farmers Bank Bldg., Fresno, Cal. W. F. Chandler, President. H. H. Welsh, Secretary. May 20, 1916. \$100,000. Three wells, Fresno County.

**LAKESHORE OIL COMPANY,**

510 Crocker Bldg., San Francisco, Cal. Geo. T. Cameron, President. R. A. Morton, Secretary. October 22, 1909. \$750,000. (Operated by Universal Oil Company.)

**LAKEVIEW ANNEX OIL COMPANY,**

Room 316, 430 S. Broadway, Los Angeles, Cal. November 21, 1910. \$2,000,000.

**\*LAKEVIEW NO. 2 OIL COMPANY,**

1011 Wright & Callendar Bldg., Los Angeles, Cal. C. H. White, President. F. G. White, Secretary. May 11, 1910. \$1,000,000. Six wells, Kern County.

**\*LAKEVIEW OIL COMPANY,**

1114 Union Oil Bldg., Los Angeles, Cal. W. L. Stewart, President. John McPeak, Secretary. December 9, 1908. \$2,500,000. Five wells, Kern County.

**LENNON OIL COMPANY,**

120 W. D St., Coalinga, Cal. Care H. R. Crozier. January 15, 1907. \$75,000.

**LEROY OIL COMPANY,**

241 Sansome St., San Francisco, Cal. M. C. Hunter, President. Phil Heuer, Secretary. February 3, 1913. \$100,000.

**LIBERTY BELL OIL COMPANY,**

502 First National Bank Bldg., Oakland, Cal. Care M. E. Bruner. May 5, 1916. \$1,000,000.

**LIBERTY OIL AND REFINING COMPANY,**

812 Syndicate Bldg., Oakland, Cal. Care Peck, Bunker & Cole. October 30, 1917. \$200,000.

**LIBERTY PETROLEUM COMPANY,**

118 West Center St., Anaheim, Cal. Lee C. Deming, President. C. C. Randall, Secretary. June 19, 1918. \$100,000.

**LIGHT OIL EXTENSION COMPANY,**

Room 637, 58 Sutter St., San Francisco, Cal. Louis Nathan, President. Chas. G. Wilcox, Secretary. November 25, 1908. \$500,000.

**\*LILLIS, J. E.,**

Summerland, Cal. Ten wells, Santa Barbara County.

**LINCOLN OIL COMPANY,**

708 Hibernian Bldg., Los Angeles, Cal. Care John S. Steely. October 15, 1917. \$10,000.

**LINDA VISTA OIL COMPANY,**

1206 Broadway, Oakland, Cal. E. A. Heron, President. A. H. Breed, Secretary. November 23, 1900. \$250,000. (Dissolved.)

**LINDSAY INCORPORATED OIL COMPANY,**

Lindsay, Cal. L. A. Sturgeon, President. L. G. Stallings, Secretary. November 11, 1909. \$200,000.

**LION OIL COMPANY,**

474 N. First St., San Jose, Cal. S. W. Waterhouse, President. Annie C. Waterhouse, Secretary. September 2, 1914. \$25,000. (Dissolved.)

**\*LISCOMB & BRIDGE,**

1183 Garfield Ave., Pasadena, Cal. A. H. Liscomb, Managing Partner. Six wells, Kern County.

**LITTLE JACK OIL COMPANY,**

305 E Sixth St., Hanford, Cal. Care Thos. Downing, President. May 16, 1912. \$100,000.

**LITTLE SESPE CONSOLIDATED OIL COMPANY,**

2388 W. 21st St., Los Angeles, Cal. O. W. Roberts, President. W. P. Martin, Secretary. August 1, 1905. \$30,000. Ventura County.

**LOMA OIL COMPANY,**

648 S. Olive St., Los Angeles, Cal. Frank A. Garbutt, President. Samuel C. Hall, Secretary. October 14, 1895. \$50,000.

**LOMPOC MONARCH OIL COMPANY,**

349 Rialto Bldg., San Francisco, Cal. Howard A. Broughton, President. L. Huseman, Secretary. May 25, 1914. \$1,000,000.

**LOMPOC OIL DEVELOPING COMPANY,**

Lompoc, Cal. Care F. J. Miller, Secretary. W. J. Packard, President. September 4, 1900. \$300,000.

**LOPEZ CANYON OIL COMPANY,**

74 New Montgomery St., San Francisco, Cal. Care A. L. Darrow. February 14, 1907. \$500,000.

**LOS ALAMOS PETROLEUM COMPANY,**

1004 Title Insurance Bldg., Los Angeles, Cal. Oliver C. Edwards, President. Jay Spence, Secretary. October 2, 1907. \$500,000.

**LOS ANGELES COALINGA OIL SYNDI-CATE,**

307 Severance Bldg., Los Angeles, Cal. W. C. Elderton, President. W. W. Pedder, Secretary. July 8, 1909. \$60,000. (Dissolved.)

**\*LOS ANGELES KERN OIL COMPANY,**

1007 Haas Bldg., Los Angeles, Cal. M. W. Parker, President. H. W. Pettebone, Secretary. December 10, 1908. \$400,000. Three wells, Kern County. (Dissolved.)

**LOS ANGELES OIL COMPANY,**

1114 Union Oil Bldg., Los Angeles, Cal. W. L. Stewart, President. John McPeak, Secretary. October 23, 1874. \$1,000,000, Orig.; \$50,000 Dec.

**LOS FLORES LAND AND OIL COMPANY,**

510 Crocker Bldg., San Francisco, Cal.  
R. N. Bishop, President. R. A. Morton,  
Secretary. July 25, 1902. \$1,000,000.  
Santa Barbara County.

**LOST HILLS INVESTMENT COMPANY,**

58 Sutter St., San Francisco, Cal. O.  
Scribner, President. M. B. Downing,  
Secretary. December 20, 1911. \$24,000.

**LOST HILLS MINING COMPANY,**

510 Crocker Bldg., San Francisco, Cal.  
Geo. T. Cameron, President. R. A.  
Morton, Secretary. March 12, 1909.  
\$36,800, Orig.; \$100,000 Inc. (Operated  
by Universal Oil Company.)

**\*LOWELL OIL COMPANY,**

9 Main St., San Francisco, Cal. A. N.  
Baldwin, Secretary. Ten wells, Kern  
County.

**\*LUCILE OIL COMPANY,**

P. O. Box 37, Coalinga, Cal. Ida R.  
Robertson, President. R. W. Dallas,  
Secretary. February 23, 1905. \$50,000.  
Fresno County.

**LUCKY BOY OIL COMPANY,**

632 Wesley Roberts Bldg., Los Angeles,  
Cal. Warren Gillilen, President. Wm.  
K. Weaver, Secretary. September 14,  
1909. \$750,000. Kern County.

**\*MAINE STATE OIL COMPANY,**

Insurance Exchange, San Francisco, Cal.  
F. W. McNear, President. J. P. Roth-  
well, Secretary. January 16, 1900.  
\$250,000. Six wells, Fresno County.

**MAJESTIC OIL COMPANY,**

Santa Maria, Cal. F. C. Twitchell,  
President. Geo. P. Merritt, Secretary.  
June 15, 1907. \$500,000.

**\*M. & T. OIL COMPANY,**

703 Syndicate Bldg., Oakland, Cal. E.  
N. Moor, President. Stewart S. Haw-  
ley, Secretary. January 15, 1910.  
\$300,000. Two wells, Kern County.

**MAMMOTH OIL COMPANY,**

597 Monadnock Bldg., San Francisco,  
Cal. J. R. Murphy, Assistant Secre-  
tary. Kern County. (Dissolved.)

**\*MANLEY & MCGINN,**

597 Monadnock Bldg., San Francisco,  
Cal. J. R. Murphy, Agent. Sixteen  
wells, Kern County.

**MARATHON OIL COMPANY,**

First National Bank Bldg., Dinuba, Cal.  
E. C. Snell, President. Karl R. Den-  
nis, Secretary. May 19, 1909. \$75,000.

**MARIAN OIL COMPANY OF COALINGA,**

Coalinga, Cal. O. D. Loftus, President.  
J. A. Fluetsch, Secretary. March 25,  
1909. \$150,000. Fresno County.

**MARICOPA INVESTMENT COMPANY,**

2223 Tenth Street, Bakersfield, Cal. W.  
J. Schultz, President. E. L. Schultz,  
Secretary. May 25, 1910. \$25,000.  
Kern County.

**\*MARICOPA NATIONAL PETROLEUM COMPANY,**

P. O. Box 411, Fresno, Cal. A. S. Cleary,  
President. E. V. Williams, Secretary.  
February 16, 1910. \$400,000. Two  
wells, Kern County.

**MARICOPA OIL COMPANY OF CALIFORNIA,**

61 N. Main St., Napa, Cal. Care Theo.  
W. Bernhard, Secretary. W. J.  
Schultz, President. December 11, 1915.  
\$100,000.

**MARICOPA QUEEN OIL COMPANY,**

216 Marine Bank Bldg., Long Beach,  
Cal. A. H. Smith, President. Otis  
Frey, Secretary. October 8, 1910.  
\$1,000,000.

**\*MARICOPA STAR OIL COMPANY,**

1004 Security Bldg., Los Angeles, Cal.  
Thos. A. O'Donnell, President. Ellis  
T. Yarnell, Secretary. October 29,  
1913. \$100,000. Three wells, Kern  
County.

**\*MARICOPA 36 OIL COMPANY,**

Alaska Commercial Bldg., San Fran-  
cisco, Cal. A. H. Greenewald, Presi-  
dent. Wm. Herlitz, Secretary. Feb-  
ruary 3, 1910. \$250,000. Two wells,  
Kern County.

**\*MARINA OIL COMPANY,**

324 Sansome St., San Francisco, Cal.  
John Barneson, President. J. Leslie  
Barneson, Secretary. November 25,  
1916. \$750,000. Twenty-four wells, Kern  
County.

**MARION OIL COMPANY,**

706 Flatiron Bldg., San Francisco, Cal.  
Henry Ach, President. A. A. Power,  
Secretary. November 5, 1908. \$600,000.  
Kern County.

**\*MASCOT OIL COMPANY,**

489 I. W. Hellman Bldg., Los Angeles,  
Cal. T. Spellacy, President. P. E.  
Spellacy, Secretary. November 11,  
1901. \$500,000. Forty-four wells, Kern  
County.

**MAUSARD, R., and JAMESON, A. L.,**

435 Security Bldg., Los Angeles, Cal.  
One well, Ventura County. (Wildcat.)

**MAXWELL OIL COMPANY,**

716 Sheldon Bldg., San Francisco, Cal.  
A. F. L. Bell, President. Albert W.  
Potts, Secretary. January 27, 1910.  
\$250,000.

**\*MAY, MARY AGNES, ET AL.,**

Drawer No. 5, Bakersfield, Cal. Seven  
wells, Kern County.

**\*MAY OIL COMPANY,**

607 S. Hill St., R. 421, Los Angeles, Cal.  
Wm. Mead, President. L. Schenck,  
Secretary. May 7, 1902. \$200,000.  
Nine wells, Kern County.

**MAYS CONSOLIDATED OIL COMPANY,**

311 California St., San Francisco, Cal.  
F. B. Chapin, President. F. Johnson,  
Secretary. May 19, 1911. \$100,000.

**\*MCCUTCHEN BROS.,**

Maricopa, Cal. Geo. W. McCutchen,  
Secretary. Seven wells, Kern County.

**MCGINLEY OIL COMPANY,**

414 Merritt Bldg., Los Angeles, Cal.

**McKITTRICK EXTENSION OIL COMPANY,**

1527 Nineteenth St., Bakersfield, Cal.  
S. P. Wible, President. C. Brower,  
Secretary. November 1, 1900. \$350,000.

**McKITTRICK FRONT OIL COMPANY,**

1112 Merchants National Bank Bldg.,  
San Francisco, Cal. W. F. William-  
son, President. A. G. Dibblee, Secre-  
tary. April 29, 1910. \$50,000.

**MARICOPA NORTHERN OIL COMPANY,**  
347 Title Insurance Bldg., Los Angeles,  
Cal. C. J. Heyler, President. M. M.  
Miles, Secretary. August 21, 1914.  
\$1,000,000.

**\*McKITTRICK OIL COMPANY,**  
Brower Bldg., Bakersfield, Cal. H. A.  
Jastro, President. C. Brower, Sec-  
retary. November 18, 1899. \$500,000.  
Two wells, Kern County.

**McKITTRICK PROSPERITY PETRO-  
LEUM COMPANY,**  
227 Sacramento St., Nevada City, Cal.  
A. R. Lord, President. C. W. Chap-  
man, Secretary. November 20, 1900.  
\$500,000.

**\*McQUIGG BROS.,**  
Union Oil Bldg., Los Angeles, Cal. H.  
M. McQuigg, Manager. Kern County.

**\*MECCA OIL COMPANY,**  
Bakersfield, Cal. D. H. McConnell,  
President. A. D. Henderson, Secre-  
tary. April 23, 1901. \$450,000. Four-  
teen wells, Kern County.

**\*MECCA OIL COMPANY NO. 2,**  
Bakersfield, Cal. D. H. McConnell,  
President. A. D. Henderson, Secre-  
tary. July 9, 1912. \$100,000. Seven  
wells, Kern County.

**\*MELITA OIL COMPANY,**  
607 First National Bank Bldg., San  
Francisco, Cal. Thos. G. Hutt, Presi-  
dent. A. Whearty, Secretary. Decem-  
ber 23, 1915. \$20,000. Fifteen wells,  
Kern County.

**MELTON OIL COMPANY,**  
511 American Bank Bldg., Los Angeles,  
Cal. Care Paul Nourse. March 12,  
1917. \$50,000.

**\*MERCANTILE CRUDE OIL COMPANY,**  
Grant Bldg., San Francisco, Cal. Peter  
Cauhu, President. P. B. Stumpf, Sec-  
retary. December 18, 1900. \$200,000.  
Five wells, Fresno County.

**MERCED PARAFFINE OIL COMPANY,**  
Los Banos, Cal. A. H. Salau, President.  
S. P. Geehrn, Secretary. June 9, 1914.  
\$1,000,000.

**MERICOS OIL COMPANY,**  
524 Auditorium Bldg., Los Angeles, Cal.  
Burton E. Green, President. Calvin C.  
Green, Secretary. November 7, 1901.  
\$100,000, Orig.; \$10,000 Dec.

**MEXICAN ASSOCIATED OIL COMPANY,**  
232 S. Broadway, Los Angeles, Cal.  
Care Chas. L. Wilde, Secretary. April  
1, 1910. \$1,500,000.

**MEXICAN PETROLEUM COMPANY,**  
1015 Security Bldg., Los Angeles, Cal.  
E. L. Doheny, President. O. D. Ben-  
nett, Secretary. December 20, 1900.  
\$10,000,000.

**MIDAS OIL COMPANY,**  
409 Hosfield Bldg., Los Angeles, Cal. H.  
P. Cortelyou, President. John W.  
Cooke, Secretary. June 20, 1917.  
\$20,000.

**MIDGET OIL COMPANY,**  
60 California St., San Francisco, Cal.  
J. D. Spreckels, Jr., President. W. H.  
Hannam, Secretary. April 11, 1910.  
\$25,000.

**\*MIDLAND OIL COMPANY, THE,**  
1034 Security Bldg., Los Angeles, Cal.  
I. W. Fuqua, Vice President. Norman  
Bridge, Secretary. November 20, 1908.  
\$100,000. Six wells, Kern County.

**\*MIDLANDS OILFIELDS COMPANY,  
LTD.,**  
1034 Security Bldg., Los Angeles, Cal.  
T. A. O'Donnell, President. Norman  
Bridge, Secretary. April 15, 1910  
\$1,000,000. Four wells, Kern County.

**MID STATE OIL COMPANY,**  
Bank of Italy Bldg., Santa Rosa, Cal.  
Care Ross Campbell. February 15,  
1918. \$10,000.

**MIDWAY BASIN OIL COMPANY,**  
230 American Bank Bldg., Monrovia, Cal.  
Augustus G. Stearns, President. Her-  
bert J. Evans, Secretary. April 13,  
1910. \$500,000.

**MIDWAY COLUMBIAN OIL COMPANY,  
LTD.,**  
744 Hastings St., W., Vancouver, B. C.  
Wm. A. Bauer, President. J. W.  
Bauer, Secretary. June 18, 1912.  
\$500,000. Kern County.

**\*MIDWAY CONSOLIDATED LIMITED,**  
P. O. Box 79, Fellows, Cal. Capt. A. C.  
Adams, President. C. F. Burton, Sec-  
retary. October 21, 1913. \$100,000.  
Two wells, Kern County.

**\*MIDWAY FIELDS OIL COMPANY,**  
Garland Bldg., 740 S. Broadway, Los An-  
geles, Cal. C. E. Groat, President.  
Ben R. Meyer, Secretary. August 8,  
1910. \$1,000,000. One well, Kern  
County.

**\*MIDWAY FIVE OIL COMPANY,**  
622 I. W. Hellman Bldg., Los Angeles,  
Cal. Edwin L. Martin, President. F.  
L. Bortalls, Secretary. March 22, 1910.  
\$1,000,000. Five wells, Kern County.

**\*MIDWAY GAS COMPANY,**  
809 Garland Bldg., Los Angeles, Cal. F.  
Reis, Jr., President. W. S. Pardy,  
Secretary. November 18, 1911. \$3,-  
500,000. Four wells, Kern County.

**\*MIDWAY NORTHERN OIL COMPANY,**  
347 Title Insurance Bldg., Los Angeles,  
Cal. W. S. McGiffert, President. M.  
M. Miles, Secretary. October 15, 1910.  
\$1,000,000. Three wells, Kern County.

**\*MIDWAY OIL COMPANY,**  
Room 603. 310 Sansome St., San Fran-  
cisco, Cal. James Ogden, President.  
A. Heyman, Secretary. May 4, 1901.  
\$1,000,000. Twenty-four wells, Kern  
County.

**MIDWAY OIL COMPANY,**  
302 Concord Bldg., Portland, Ore. Chas.  
E. Ladd, President. A. E. Davis, Sec-  
retary. May 4, 1901. \$1,000,000.

**\*MIDWAY PACIFIC OIL COMPANY,  
THE,**  
1058 S. Flower St., Los Angeles, Cal.  
Philip L. Wilson, President. P. F.  
Schumacher, Secretary. April 18,  
1910. \$2,000,000. Five wells, Kern  
County.

- \*MIDWAY PEERLESS OIL COMPANY,**  
617 Merritt Bldg., Los Angeles, Cal.  
M. H. Whittier, President. H. L.  
Westbrook, Secretary. February 28,  
1911. \$600,000. Fourteen wells, Kern  
County.
- \*MIDWAY PREMIER OIL COMPANY,**  
1103 Federal Realty Bldg., Oakland, Cal.  
A. J. Snyder, President. L. E. Bower,  
Secretary. March 18, 1910. \$1,000,000.  
Nine wells, Kern County.
- \*MIDWAY ROYAL PETROLEUM COM-  
PANY,**  
648 S. Olive St., Los Angeles, Cal.  
Frank A. Garbutt, President. S. C.  
Hall, Secretary. October 13, 1910.  
\$1,000,000. Eleven wells, Kern County.
- M. J. AND M. & M. CONSOLIDATED,**  
2779 Poplar St., Oakland, Cal. Bernard  
Ransome, President. Emery W. Elliot,  
Secretary. August 22, 1910. \$2,000,000.  
Kern County. (Property leased to  
Standard Oil Company.)
- \*MILES, WILLIAM E.,**  
68 Post St., San Francisco, Cal. Five  
wells, Kern County.
- \*MILLIE FRANCIS OIL COMPANY,**  
Box 8, Taft, Cal. T. O. May, Superin-  
tendent. Seven wells, Kern County.
- MINORU OIL COMPANY,**  
310 Sansome St., San Francisco, Cal.  
John Barneson, President. W. J.  
Dinsmore, Secretary. June 2, 1909.  
\$500,000.
- \*MIOCENE OIL COMPANY,**  
Maricopa, Cal. P. Welch, President.  
R. G. Lauer, Secretary. July 5, 1912.  
\$20,000. Two wells, Kern County.
- M. K. AND T. OIL COMPANY,**  
201 First Savings Bank Bldg., Oakland,  
Cal. George D. Metcalf, President.  
John B. Metcalf, Secretary. Janu-  
ary 15, 1900. \$300,000. Fresno County
- \*MOCAL OIL COMPANY,**  
Shale, Kern County, Cal. Chas. Ritters-  
bacher, President. Elmer Ritters-  
bacher, Secretary. June 3, 1911.  
\$300,000. Five wells, Kern County.
- \*MODELO OIL COMPANY,**  
300 Crocker Bldg., San Francisco, Cal.  
A. F. Morrison, President. W. R.  
Berry, Secretary. April 26, 1898.  
\$250,000. Nine wells, Ventura County.
- MOGUL OIL COMPANY,**  
Visalia, Cal. Care L. C. Branch.  
I. Shiffert, President. L. C. Branch,  
Secretary. October 6, 1909. \$100,000.
- MONARCH OIL COMPANY,**  
1809 Chester Ave., Bakersfield, Cal.  
L. V. Olcese, President. J. B. Hewitt,  
Secretary. February 3, 1900. \$100,000.
- MONTANA FRESNO OIL COMPANY,**  
1245 I St., Fresno, Cal. W. M. Wyatt,  
President. Wm. F. Dunn, Secretary.  
January 14, 1900. \$14,000.
- \*MONTANA-WYOMING OIL COMPANY,**  
426 McIntyre Bldg., Salt Lake City,  
Utah. Wm. Spry, President. A. B.  
Carstensen, Secretary. October 1,  
1917. \$250,000. One well, Kern  
County.
- MONTEBELLO CRUDE OIL COMPANY,**  
Care Goodwin & Mortgage, 1117 Title  
Insurance Bldg., Los Angeles. Au-  
gust 7, 1918. \$500,000.
- MONTEBELLO NUMBER ONE OIL  
COMPANY,**  
Room 602, 256 S. Spring St., Los Angeles,  
Cal. Care Geo. A. Boden. January 4,  
1918. \$200,000.
- MONTEBELLO NATIONAL OIL COM-  
PANY,**  
1124 Title Insurance Bldg., Los Angeles,  
Cal. August 30, 1918. \$100,000.
- MONTEBELLO NATIONAL OIL COM-  
PANY,**  
Care Sol. A. Rehart, 1103 Hollingsworth  
Bldg., Los Angeles, Cal. July 22, 1918.  
\$1,500,000. (Arizona Corporation.)
- \*MONTEBELLO OIL COMPANY,**  
433 California St., San Francisco, Cal.  
Chas. W. Gardner, President. A. E.  
Boynton, Secretary. May 5, 1909.  
\$1,000,000. Eighty-three wells, Ven-  
tura County.
- \*MONTGOMERY, BUELAH J.,**  
R. F. D. No. 1, Box 39, Bakersfield,  
Cal. Kern County. (Property oper-  
ated by Davis-McPhail Oil Company.)
- MOUNT DIABLO OIL, MINING AND  
DEVELOPMENT COMPANY,**  
517 Central Bldg., Los Angeles, Cal.  
Jas. Cullingham, President. N. K.  
Potter, Secretary. February 23, 1900.  
\$500,000. Kern County.
- M. P. OIL COMPANY,**  
Care Security Trust Company, Bakers-  
field, Cal. Arthur S. Crites, Presi-  
dent. M. P. Flickinger, Secretary.  
May 8, 1909. \$21,000.
- MUNROE OIL COMPANY,**  
521 W. P. Story Bldg., Los Angeles,  
Cal. Geo. W. Walker, President. F.  
V. Gordon, Secretary. April 25, 1912.  
\$50,000.
- MURIEL OIL COMPANY,**  
310 Sansome St., San Francisco, Cal.  
John Barneson, President. W. J.  
Dinsmore, Secretary. April 22, 1909.  
\$250,000.
- \*MURPHY, W. J.,**  
2112 Truxton Ave., Bakersfield, Cal.  
Two wells, Kern County.
- MURPHY OIL COMPANY,**  
Box "M," Whittier, Cal. William H.  
Murphy, President. J. T. F. Baeyertz,  
Secretary. August 18, 1904. \$2,000,-  
000. Los Angeles County and Or-  
ange County.
- \*MUSCATINE OIL COMPANY,**  
814 Merchants National Bank Bldg.,  
Los Angeles, Cal. Mira Hershey,  
President. G. C. Macfarland, Secre-  
tary. August 3, 1908. \$20,000, Orig.:  
\$300,000, Inc. Five wells, Kern Coun-  
ty. (Sold to Mira Hershey, who  
will operate under name of Good  
Hope Wells.)
- \*MUTUAL OIL COMPANY,**  
1006 California Bldg., Los Angeles, Cal.  
R. G. Holton, President. Grace L.  
Stevens, Secretary. May 11, 1907.  
\$100,000. One well, Ventura County.

- \*MYRICK, RUTH K. (MRS.),**  
404-5 International Bank Bldg., Los Angeles, Cal. O. H. Myrick, Agent. Eight wells, Kern County.
- \*NACIREMA OIL COMPANY,**  
410 Brower Bldg., Bakersfield, Cal. Robt. Law, Jr., President. E. C. Reed, Secretary. September 29, 1909. \$50,000. Kern County.
- NATIONAL OIL COMPANY,**  
627 E. Third St., Los Angeles, Cal. H. H. Schwarz, President. B. L. Schwarz, Secretary. June 15, 1915. \$10,000. (Company advises out of business.)
- \*NATIONAL PACIFIC OIL COMPANY,**  
1011 Higgins Bldg., Los Angeles, Cal. John Barneson, President. D. W. Woods, Secretary. December 6, 1911. \$3,500,000. Two wells, Kern County.
- NATIONAL PETROLEUM COMPANY,**  
1003 Higgins Bldg., Los Angeles, Cal. Wm. Walker, President. C. R. Stevens, Secretary. April 24, 1913. \$100,000.
- NATURAL GAS AND PETROLEUM COMPANY,**  
532 Fifteenth St., Oakland, Cal. C. A. Brown, President. F. Thomas, Secretary. February 3, 1917. \$100,000.
- \*NETHERLANDS OIL COMPANY,**  
1910 Mariposa St., Fresno, Cal. W. B. Holland, President. Ben Epstein, Secretary. March 5, 1909. \$200,000. Fresno County.
- \*NEVADA COUNTY OIL COMPANY,**  
820 Union Oil Bldg., Los Angeles, Cal. D. E. Morgan, President. W. B. Robb, Secretary. September 22, 1900. \$250,000. Fourteen wells, Kern County.
- \*NEVADA PETROLEUM COMPANY, THE**  
1026 Crocker Bldg., San Francisco, Cal. A. D. Davis, President. G. D. Abbott, Secretary. December 23, 1908. \$1,000,000. Orig.; \$5,000,000. Inc. Twenty-nine wells, Kern County.
- NEW CASTAIC OIL COMPANY,**  
1525 Brooklyn Ave., Los Angeles, Cal. Geo. D. Alspach, President. Genevieve D. Garner, Secretary. March 18, 1909. \$500,000.
- \*NEW CENTER OIL COMPANY,**  
9 Main St., San Francisco, Cal. D. S. Bachman, President. A. N. Baldwin, Secretary. September 25, 1905. \$25,000. Five wells, Fresno County.
- NEW ENGLAND OIL COMPANY,**  
119 E. Colorado St., Pasadena, Cal. M. E. Wood, President. MacD. Snowball, Secretary. April 16, 1900. \$300,000.
- NEW ERA OIL COMPANY,**  
Southern Title Bldg., San Diego, Cal. Care Sumner & May. September 30, 1916. \$100,000.
- NEWHALL MOUNTAIN OIL COMPANY,**  
210 S. Hudson Ave., Pasadena, Cal. L. D. Swartwout, President. S. L. Wallis, Secretary. October 19, 1901. \$50,000.
- NEW HOPE OIL COMPANY,**  
722 Mills Bldg., San Francisco, Cal. C. S. Loumeister, Vice President. W. E. Dennison, Secretary. October 3, 1899. \$100,000.
- NEWLOVE OIL COMPANY,**  
1114 Union Oil Bldg., Los Angeles, Cal. W. W. Orcutt, President. John McPeak, Secretary. April 30, 1906. \$1,500,000. Santa Barbara County.
- NEWMAN, MORRIS OIL AND LAND COMPANY,**  
1 Powell St., San Francisco, Cal. W. W. Kaye, President. Chas. J. Newman, Secretary. January 3, 1912. \$500,000.
- NEW MEXICO OIL COMPANY,**  
Ventura, Cal. Gus Mulholland, Manager.
- \*NEW PENNSYLVANIA PETROLEUM COMPANY,**  
105 N. Broadway, Santa Maria, Cal. A. F. Fugler, President. G. M. Scott, Secretary. August 6, 1904. \$500,000. Four wells, Santa Barbara County.
- \*NEW SAN FRANCISCO CRUDE OIL COMPANY,**  
904 I St., Fresno, Cal. H. H. Welsh, Vice President. W. J. O'Neill, Secretary. January 17, 1902. \$40,000 Orig.; \$150,000 Inc. One well, Fresno County.
- \*NILES LEASE COMPANY,**  
1034 Security Bldg., Los Angeles, Cal. W. D. Stewart, Vice President. Norman Bridge, Secretary. February 17, 1908. \$1,000,000. Eight wells, Los Angeles County.
- \*NORTH AMERICAN OIL CONSOLIDATED,**  
544 Market St., San Francisco, Cal. Louis Titus, President. C. F. Nance, Secretary. February 3, 1910. \$3,000,000. Thirty-one wells, Kern County.
- NORTH MIDWAY OIL COMPANY,**  
Box 598, Care Roy Jones, Santa Monica, Cal. L. W. Andrews, President. Roy Jones, Secretary. November 8, 1909. \$200,000.
- NORTHERN OIL COMPANY,**  
9 Main St., San Francisco, Cal. A. N. Baldwin, Secretary.
- OAKBURN OIL COMPANY,**  
1063 Higgins Bldg., Los Angeles, Cal. J. W. Maddrill, President. C. R. Stevens, Secretary. February 18, 1910. \$1,000,000.
- \*OAKLAND MIDWAY OIL COMPANY,**  
612 Union Savings Bank Bldg., Oakland, Cal. G. B. M. Gray, President. James P. Taylor, Secretary. June 15, 1910. \$500,000. Four wells, Kern County.
- OAKLAND OIL COMPANY,**  
53 Sutter St., San Francisco, Cal. W. T. Sesnon, Vice President. A. J. Samuel, Secretary. September 14, 1899. \$20,000.
- \*OAK RIDGE OIL COMPANY,**  
433 California St., San Francisco, Cal. Chas. W. Gardner, President. A. E. Boynton, Secretary. January 6, 1911. \$5,000,000. Four wells, Ventura County.

**\*OBISPO OIL COMPANY,**

P. O. Box 341, San Luis Obispo, Cal.  
J. W. Barneberg, President. Francis  
H. Throop, Secretary. February 25,  
1909. \$500,000. Two wells, Kern  
County.

**OCCIDENT OIL COMPANY,**

1927 Mariposa St., Fresno, Cal. Wm.  
Helm, President. W. O. Miles, Secre-  
tary. May 13, 1899. \$32,000.

**OCTAVE OIL COMPANY,**

1004 Security Bldg., Los Angeles, Cal.  
Wm. H. Whittier, President. Thos.  
A. O'Donnell, Secretary. April 11,  
1903. \$50,000.

**\*OHIO CRUDE OIL COMPANY,**

346 Pacific Electric Bldg., Los Angeles,  
Cal. June 4, 1910. \$300,000. Kern  
County.

**\*OIL EXPLORATION COMPANY OF CALIFORNIA,**

603 Nevada Bank Bldg., San Francisco,  
Cal. Jos. Errington, President. Jas.  
P. Sweeney, Secretary. August 8,  
1910. \$300,000. Fresno County.

**\*OILFIELDS SYNDICATE,**

901 Insurance Exchange, San Francisco,  
Cal. A. E. Boynton, President. F. J.  
Mott, Secretary. September 27, 1917.  
\$250,000. One well, Santa Barbara  
County.

**OIL LAND EXPLORATION COMPANY,**

514 Humboldt Bank Bldg., San Fran-  
cisco, Cal. J. P. Fraser, President.  
H. F. Peart, Secretary. February 23,  
1909. \$250,000.

**\*OJAI OIL COMPANY,**

315 Bumiller Bldg., Los Angeles, Cal.  
F. E. Dunlap, President. W. V.  
Ambrose, Secretary. June 4, 1900.  
\$750,000. Four wells, Ventura County.

**\*OJAI VALLEY PETROLEUM COMPANY,**

207 Laughlin Bldg., Los Angeles, Cal.  
S. H. Watson, President. Jas. A.  
Haskett, Secretary. March 11, 1909.  
\$750,000. Sixteen wells, Kern County.

**OLD KEYSTONE OIL COMPANY,**

1114 Union Oil Bldg., Los Angeles, Cal.  
Lyman Stewart, President. John Mc-  
Peak, Secretary. February 15, 1897.  
\$100,000.

**OLEMA OIL COMPANY,**

824 Mills Bldg., San Francisco, Cal.  
Oliver Ellsworth, President. M. A.  
Thomas, Secretary. October 2, 1900.  
\$200,000. Kern County.

**OLEUM TERRA COMPANY,**

2706 Brighton Ave., Los Angeles, Cal.  
E. C. Freeman, President. J. G. Todd,  
Secretary. January 9, 1901. \$16,000.

**\*OLIG CRUDE OIL COMPANY,**

2827 La Salle Ave., Los Angeles, Cal.  
Geo. W. Walker, President. J. H.  
Purdy, Secretary. September 23, 1904.  
\$500,000. Seven wells, Kern County.

**OLIG LAND COMPANY,**

2827 La Salle Ave., Los Angeles, Cal.  
Geo. W. Walker, President. J. H.  
Purdy, Secretary. February 14, 1908.  
\$50,000.

**\*OLINDA LAND COMPANY,**

702 Equitable Bldg., Los Angeles, Cal.  
W. H. Bailey, Jr., President. M.  
Sutherland, Secretary. August 31,  
1900. \$2,000,000. Ten wells, Orange  
County.

**ON TOP OIL COMPANY,**

1611 Las Lunas St., Pasadena, Cal.  
J. F. Waterman, President-acting.  
V. L. O'Brien, Secretary. March 29,  
1915. \$25,000. Kern County.

**OPHIR OIL COMPANY,**

310 Sansome St., San Francisco, Cal.  
John Barneson, President. J. Leslie  
Barneson, Secretary. October 7, 1909.  
\$100,000. Fresno County. (Operated  
by C. B. Cates Company since Sep-  
tember, 1918.)

**\*ORCUTT OIL COMPANY,**

Lompoc, Cal. A. Lehmann, President.  
J. A. Day, Secretary. December 31,  
1907. \$300,000. Five wells, Santa  
Barbara County.

**OSAGE FIFTY-EIGHT OIL COMPANY,**

1420 Orange Drive, Los Angeles, Cal.  
D. B. Mason, President. F. M. Over-  
lees, Secretary. March 6, 1905.  
\$500,000.

**OTAY OIL COMPANY,**

902 American National Bank Bldg., San  
Diego, Cal. J. W. Dougherty, Presi-  
dent. Isabel Wyatt, Secretary. Janu-  
ary 3, 1910. \$125,000.

**\*OZARK OIL COMPANY,**

P. O. Box 564, Los Angeles, Cal. W. P.  
James, President. O. H. Burke, Secre-  
tary. July 18, 1907. \$250,000. Four  
wells, Fresno County.

**OZENA OIL COMPANY,**

231 E. Sixth St., Los Angeles, Cal.  
Hugh Scott, President. Albert Lane,  
Secretary. April 17, 1916. \$200,000.

**\*PACIFIC CRUDE OIL COMPANY,**

112 Market St., San Francisco, Cal.  
G. N. Easton, President. John Lee,  
Jr., Secretary. May 19, 1911. \$750,000.  
Three wells, Kern County.

**\*PACIFIC MIDWAY OIL COMPANY,**

822 Mills Bldg., San Francisco, Cal.  
B. S. Noyes, President. Benjamin  
Romaine, Secretary. January 31,  
1910. \$250,000. Five wells, Kern  
County.

**PACIFIC OILFIELDS LIMITED,**

350 California St., San Francisco, Cal.  
A. B. Williamson, President. F. W.  
Bishop, Secretary. December 23, 1907.  
£250,000. San Luis Obispo County and  
Santa Barbara County.

**\*PACIFIC STATES PETROLEUM COM-  
PANY,**

P. O. Box "B2," Coalinga, Cal. G. W.  
Richard, President. L. L. Richard,  
Secretary. April 23, 1909. \$300,000.  
One well, Fresno County.

**PALMER ANNEX OIL COMPANY,**

1000 Title Insurance Bldg., Los Angeles,  
Cal. Shirley E. Meserve, President.  
J. R. Whittemore, Secretary. June 5,  
1909. \$2,000,000.

- \*PALMER UNION OIL COMPANY,**  
Box 202, Santa Barbara, Cal. J. M. Williamson, President. M. F. Lewis, Secretary. December 5, 1910. \$10,000,000. Five wells, Kern County; 7 wells, Santa Barbara County.
- \*PALM AMERICAN PETROLEUM COMPANY,**  
1015 Security Bldg., Los Angeles, Cal. E. L. Doheny, President. O. D. Bennett, Secretary. September 11, 1916. \$1,000,000. Fifty-three wells, Kern County; 29 wells, Ventura County.
- \*PALM AMERICAN PETROLEUM INVESTMENT CORPORATION,**  
1015 Security Bldg., Los Angeles, Cal. E. L. Doheny, President. O. D. Bennett, Secretary. October 30, 1916. \$5,000,000. Five wells, Santa Barbara County.
- \*PANTHEON OIL COMPANY,**  
55 New Montgomery St., San Francisco, Cal. A. C. McLaughlin, President. P. G. Williams, Secretary. February 28, 1910. \$750,000. Seven wells, Fresno County.
- \*PARAFFINE OIL COMPANY,**  
Box 556, Bakersfield, Cal. H. F. Condict, President. T. H. Minor, Secretary. January 24, 1901. \$300,000. Five wells, Kern County.
- PARAFFIN OIL PRODUCTS COMPANY,**  
Care John M. Cannon, 901 Hollingsworth Bldg., Los Angeles, Cal. July 26, 1917. \$200,000.
- PARAISO OIL COMPANY,**  
Syndicate Bldg., Oakland, Cal. J. E. Ennis, President. J. N. Turner, Secretary. September 18, 1914. \$200,000.
- PARKER OIL COMPANY,**  
208 Van Ness Ave., Los Angeles, Cal. Nettie A. Parker, President. M. F. Klingaman, Secretary. May 16, 1900. \$250,000.
- \*PATRICIA OIL COMPANY,**  
P. O. Box 441, Bakersfield, Cal. F. A. Carrick, President. A. C. Tupman, Secretary. May 21, 1910. \$250,000. Seventeen wells, Kern County.
- PAUSON OIL COMPANY,**  
180 Sutter St., San Francisco, Cal. S. B. Pauson, President. J. W. Pauson, Secretary. November 5, 1904. \$100,000.
- P. C. L. OIL COMPANY,**  
111 N. Church St., Visalia, Cal. Care Chas. G. Lamberson. Geo. T. Parr, President. John Cutler, Secretary. November 26, 1909. \$100,000.
- \*PEERLESS OIL COMPANY,**  
824 Crocker Bldg., San Francisco, Cal. T. C. Petersen, President. H. C. Park, Secretary. October 9, 1899. \$1,000,000. Sixty-five wells, Kern County. (Now operated by Arizona Oil Company.)
- \*PENN COALINGA PETROLEUM COMPANY,**  
607 First National Bank Bldg., San Francisco, Cal. I. L. Bryner, President. Robt. Hays Smith, Secretary. June 26, 1905. \$350,000. Ten wells, Fresno County.
- PENTLAND UNION PETROLEUM COMPANY,**  
401 Union Oil Bldg., Los Angeles, Cal. Edward Fox, President. F. C. Lamb, Secretary. June 29, 1912. \$15,000.
- PERSEUS OIL COMPANY,**  
207 S. Broadway, Los Angeles, Cal. T. Dudley, President. W. H. Dowsing, Secretary. March 7, 1901. \$200,000. Kern County.
- PETROL COMPANY, THE,**  
Santa Susana, Cal. W. S. Baylis, Secretary. Ventura County. (Dissolved.)
- PETROL CORPORATION OF AMERICA, THE,**  
Care Robt. M. Clarke. 918 Merchants National Bank Bldg., Los Angeles, Cal. July 17, 1918. \$250,000.
- \*PETROLEUM COMPANY, THE,**  
407-8 Consolidated Realty Bldg., Los Angeles, Cal. M. H. Mosier, President. Chas. T. Wilson, Secretary. September 30, 1910. \$250,000. Four wells, Orange County.
- \*PETROLEUM DEVELOPMENT COMPANY,**  
756 Kerckhoff Bldg., Los Angeles, Cal. E. O. Faulkner, President. G. Holterhoff, Jr., Secretary. May 26, 1899. \$125,000. Sixty-nine wells, Orange County; 118 wells, Kern County.
- \*PETROLEUM MIDWAY COMPANY, LTD.,**  
1034 Security Bldg., Los Angeles, Cal. W. D. Stewart, Vice President. Norman Bridge, Secretary. February 15, 1915. \$1,000,000. Ten wells, Kern County.
- PETROLIA OIL COMPANY,**  
Tulare and J Sts., Tulare, Cal. A. W. Wheeler, President. W. A. Higgins, Secretary. June 29, 1899. \$50,000.
- PHOENIX OIL COMPANY,**  
P. O. Box 416, Hanford, Cal. P. McRae, President. W. R. McQuiddy, Secretary. November 28, 1898. \$100,000.
- PIEDMONT OIL COMPANY,**  
1206 Broadway, Oakland, Cal. A. H. Breed, President. H. L. Breed, Secretary. December 17, 1900. \$4,000. Kern County. (Property sold; now operated by A. S. Crites.)
- PIERCE PETROLEUM COMPANY,**  
Care Herman Laver & Company, Hobart Bldg., San Francisco, Cal. December 4, 1918. \$1,000,000.
- \*PIERPONT OIL COMPANY,**  
Box 196, Los Angeles, Cal. Wm. Hardee, President. F. W. Black, Secretary. March 29, 1909. \$500,000. Twelve wells, Kern County.
- \*PILOT OIL COMPANY,**  
607 First National Bank Bldg., San Francisco, Cal. H. J. Doulton, President. G. A. Scott, Secretary. May 9, 1908. \$100,000. Orig.; \$200,000, Inc. Seven wells, Fresno County.
- PINAL DOME OIL COMPANY,**  
Santa Maria, Cal. J. F. Goodwin, President. Geo. P. Merritt, Secretary. June 21, 1912. \$360,000. (Property sold to Union Oil Company.)

- PINE RIDGE PETROLEUM COMPANY,**  
Coalinga, Cal. M. L. Boles, President.  
J. A. Fluetsch, Secretary. May 8,  
1917. \$50,000.
- PIONEER MIDWAY OIL COMPANY,**  
411 Montgomery St., San Francisco, Cal.  
I. Strasburger, President. A. E. Cole,  
Secretary. August 17, 1907. \$1,000,000.
- \*PIONEER MIDWAY OIL COMPANY,  
CONSOLIDATED,**  
55 New Montgomery St., San Francisco,  
Cal. Wm. Sproule, President. P. G.  
Williams, Secretary. June 13, 1910.  
\$2,000,000. Two wells, Kern County.
- PIRU OIL COMPANY,**  
300 Crocker Bldg., San Francisco, Cal.  
W. Gregg, Jr., President. W. R.  
Berry, Secretary. January 21, 1887.  
\$100,000.
- \*PITTSBURGH BELRIDGE OIL COM-  
PANY,**  
454 California St., San Francisco, Cal.  
Fentress Hill, Vice President. Wen-  
dell S. Kuhn, Secretary. April 12,  
1912. \$250,000. Kern County.
- PITTSBURGH OIL AND GAS COMPANY,**  
Bakersfield, Cal. Care R. A. Broomfield.  
April 9, 1918. \$2,000,000.
- PITTSBURGH PACIFIC OIL COMPANY,**  
410 Brower Bldg., Bakersfield, Cal.  
Care R. A. Broomfield. June 4, 1914.  
\$1,000,000.
- PLACERITA PETROLEUM COMPANY,  
THE,**  
Care Route & Hinman, 307 Exchange  
Bldg., Los Angeles, Cal. October 18,  
1918. \$200,000.
- PLEASANT VALLEY OIL COMPANY,  
LTD.,**  
Care Universal Oil Company, Lost Hills,  
Cal. T. A. Crumpton, President. I.  
M. Conkey, Secretary. August 16,  
1911. \$15,000.
- PLEYTO CONSOLIDATED OIL COM-  
PANY,**  
323 Kearny St., San Francisco, Cal.  
C. W. Jackson, President. J. C. Cur-  
rier, Secretary. April 15, 1912. \$400,000.
- POMONA OIL COMPANY,**  
Care E. B. Core, 943 Title Insurance  
Bldg., Los Angeles, Cal. September  
23, 1918. \$500,000.
- PORTOLA OIL COMPANY,**  
798 Minnesota St., San Francisco, Cal.  
Geo. P. Moore, President. N. A. Rob-  
inson, Secretary. June 11, 1917. (No  
par value.)
- POSO CREEK OIL COMPANY,**  
Care S. L. Mack, Southern Hotel, Bak-  
ersfield, Cal. S. P. Wible, President.  
S. L. Mack, Secretary. November 22,  
1899. \$100,000. (Dissolved.)
- POSTON OIL COMPANY,**  
Box 354, Santa Clara, Cal. J. C. Suth-  
erland, President. G. E. Hamilton,  
Secretary. October 29, 1899. \$30,000.
- \*POTTER OIL COMPANY OF CALI-  
FORNIA,**  
410 Brower Bldg., Bakersfield, Cal. Robt.  
Law, Jr., President. J. H. Healey,  
Secretary. April 26, 1915. \$500,000.  
Thirty-one wells, Kern County.
- \*PRAIRIE OIL COMPANY,**  
Care Alex. Work, President, Bakersfield  
Club, Bakersfield, Cal. T. V. Daub,  
Secretary. April 14, 1916. \$50,000.  
One well, Kern County.
- \*PREMIER OIL COMPANY,**  
516 Citizens National Bank Bldg., Los  
Angeles, Cal. T. Spellacy, President.  
B. H. Wallace, Secretary. September  
5, 1907. \$1,000,000. Sixteen wells.  
Fresno County.
- \*PRICEWELL OIL COMPANY,**  
Wilcox Bldg., Los Angeles, Cal. A. D.  
Elwell, President. C. E. Price, Secre-  
tary. March 20, 1909. \$50,000. Eight  
wells, Kern County.
- \*PRINCETON OIL COMPANY,**  
208 Brower Bldg., Bakersfield, Cal. H.  
A. Jastro, President. C. A. Barlow,  
Secretary. January 7, 1913. \$50,000.  
Three wells, Kern County.
- PRODUCERS OIL COMPANY, GUARAN-  
TEED,**  
1945 Tulare St., Fresno, Cal. B. F.  
Shepherd, Jr., President. N. G. Coch-  
rane, Secretary. October 25, 1899.  
\$500,000. Kern County.
- \*PROVIDENTIAL OIL COMPANY,**  
320 Timkin Bldg., San Diego, Cal. A. J.  
Bradley, President. J. A. Smith, Secre-  
tary. October 5, 1914. \$1,000,000.  
Three wells, Orange County.
- PROVIDENT OIL MINING COMPANY,**  
758 Market St., San Francisco, Cal. Dr.  
A. McFayden, President. C. E. Allis,  
Secretary. November 26, 1900. \$300,-  
000. Kern County.
- PUEBLO OIL COMPANY,**  
1005 Central Bldg., Los Angeles, Cal.  
Wm. R. Rowland, President. W. Ast-  
ley, Secretary. January 22, 1892.  
\$250,000.
- PURE OIL COMPANY OF SANTA  
PAULA,**  
512 S. Broadway, Los Angeles, Cal. J.  
W. Young, President. Philip Forve,  
Secretary. June 4, 1900. \$300,000.
- PURISSIMA HILLS OIL COMPANY,**  
349 Rialto Bldg., San Francisco, Cal.  
Howard A. Broughton, President.  
James Casey, Secretary. October 31,  
1908. \$1,000,000.
- PURITAN OIL COMPANY,**  
501 I. W. Hellman Bldg., Los Angeles,  
Cal. W. J. Wallace, President.  
Harry J. Bauer, Secretary. March 22,  
1916. \$100,000.
- \*PYRAMID OIL COMPANY,**  
716 Phelan Bldg., San Francisco, Cal.  
G. S. Johnson, President. Otto B.  
Johnson, Secretary. October 7, 1909.  
\$1,000,000. Five wells, Kern County;  
13 wells, Ventura County.
- \*QUEEN OIL COMPANY,**  
Care First National Bank, Los Angeles,  
Cal. W. N. Hamaker, Secretary.  
Three wells, Fresno County.
- \*QUINTUPLE OIL COMPANY,**  
388 Consolidated Realty Bldg., Los An-  
geles, Cal. R. J. Gaffney, President.  
A. E. Hurley, Secretary. July 30,  
1914. \$100,000. Two wells, Orange  
County.

**RADIUM OIL COMPANY,**

410 Montgomery St., San Francisco, Cal.  
Chas. Sutro, President. Sidney L.  
Schwartz, Secretary. April 29, 1904.  
\$250,000.

**\*RANCHO LA BREA OIL COMPANY,**

Merchants National Bank Bldg., Los  
Angeles, Cal. G. Allan Hancock,  
Executor. Fifty-eight wells, Los An-  
geles County.

**RAMBLER OIL COMPANY,**

616 Union Oil Bldg., Los Angeles, Cal.  
M. V. McQuigg, President. A. J.  
Wallace, Secretary. June 17, 1908.  
\$50,000. (Property operated by Trad-  
ers Oil Company.)

**\*RECORD OIL COMPANY,**

264 Southern Pacific Bldg., San Fran-  
cisco, Cal. H. H. Hart, President.  
W. J. Clark, Secretary. March 3, 1905.  
\$200,000. Eight wells, Fresno County.

**\*RECOVERY OIL COMPANY,**

510 Crocker Bldg., San Francisco, Cal.  
Geo. T. Cameron, President. R. A.  
Morton, Secretary. December 2, 1910.  
\$1,000,000. Four wells, Kern County.

**RECRUIT OIL COMPANY,**

55 New Montgomery St., San Francisco,  
Cal. Wm. Sproule, President. P. G.  
Williams, Secretary. May 4, 1903.  
\$1,000,000. Santa Barbara County.

**RED MAN PETROLEUM COMPANY,**

3096 California St., San Francisco, Cal.  
A. A. Cohn, President. W. I. Sterett,  
Secretary. October 27, 1911. \$300,000.

**\*RED STAR PETROLEUM COMPANY,**

1034 Security Bldg., Los Angeles, Cal.  
T. A. O'Donnell, President. W. D.  
Stewart, Secretary. June 8, 1917.  
\$500,000. One well, Los Angeles  
County.

**REFINING AND PRODUCING OIL COM-  
PANY,**

354 Pine St., San Francisco, Cal. L. A.  
Phillips, President. R. A. Broomfield,  
Secretary. May 4, 1911. \$2,250,000.

**REGAL OIL COMPANY,**

226-227 Security Bldg., Los Angeles, Cal.  
E. E. Dunlap, President. G. C. Den-  
nis, Secretary. September 12, 1908.  
\$100,000. Kern County.

**REPUBLIC OIL COMPANY,**

1118 Hearst Bldg., San Francisco, Cal.  
S. A. Guiberson, Jr., President. B. H.  
Henderson, Secretary. February 2,  
1910. \$6,000. (Dissolved.)

**RESULT OIL COMPANY,**

1016 American National Bank Bldg.,  
San Francisco, Cal. P. E. Bowles,  
President. F. W. McNear, Secretary.  
March 6, 1908. \$25,000.

**\*REVENUE OIL COMPANY,**

409 Citizens Savings Bank Bldg., Pasa-  
dena, Cal. R. H. Pinney, President.  
A. K. Nash, Secretary. March 7,  
1900. \$200,000. Eight wells, Kern  
County.

**\*REWARD OIL COMPANY,**

1016 American National Bank Bldg.,  
San Francisco, Cal. P. E. Bowles,  
President. F. W. McNear, Secretary.  
March 9, 1901. \$100,000. Forty-seven  
wells, Kern County.

**RHODES, F. C.,**

McFarland, Cal. Devil's Den.

**\*RHODES & SCHMITT,**

Alma, Cal. Wm. Rhoads, Manager.  
One well, Santa Clara County.

**\*RICE RANCH OIL COMPANY,**

710 Merchants National Bank Bldg.,  
Los Angeles, Cal. C. J. Kubach,  
President. E. A. Rang, Secretary.  
March 14, 1904. \$300,000. Thirteen  
wells, Santa Barbara County.

**RICHFIELD OIL COMPANY,**

933 Van Nuys Bldg., Los Angeles, Cal.  
F. R. Kellogg, President. G. J.  
Syminton, Secretary. November 29,  
1911. \$300,000.

**RICHFIELD PETROLEUM COMPANY,**

Care Pillsbury, Madison & Sutro,  
Standard Oil Bldg., San Francisco,  
Cal. June 21, 1918. \$500,000.

**RIO BRAVO OIL COMPANY,**

Care Wm. Palmtag, Hollister, Cal. Geo.  
D. Clark, President. Walter C.  
Graves, Secretary. February 14, 1900.  
\$100,000.

**RIO HONDO PETROLEUM COMPANY,**

Room 614, 453 S. Spring St., Los An-  
geles, Cal. Care Goodwin & Mor-  
grage. November 1, 1917. \$300,000.

**RIVA OIL AND GAS COMPANY,**

617 Merritt Bldg., Los Angeles, Cal.  
M. H. Whittier, President. Fred Sut-  
ton, Secretary. July 8, 1918. \$500,000.

**RIVERSIDE PORTLAND CEMENT  
COMPANY,**

640 Title Insurance Bldg., Los Angeles,  
Cal.

**ROANOKE OIL COMPANY,**

Room 3, Farmers National Bank,  
Fresno, Cal. Care G. L. Warlow,  
Secretary. C. S. Pierce, President.  
December 24, 1900. \$100,000.

**\*ROCK OIL COMPANY,**

1007 Washington Bldg., Los Angeles,  
Cal. L. C. Torrance, President.  
Nichols Milbank, Secretary. April 7,  
1910. \$125,000. Seven wells, Kern  
County.

**ROOT, SHOUP & MILLIKEN,**

Pacific Electric Bldg., Los Angeles, Cal.  
("Wildcat" well, Kern County.)

**ROSE OIL COMPANY,**

600 S. Broadway, Los Angeles, Cal.  
Frederick J. Mullen, President.  
James B. Sullivan, Secretary. July  
6, 1903. \$200,000.

**\*ROSE OIL COMPANY,**

Fillmore, Cal. C. E. Ingalls, President.  
One well, Ventura County.

**ROYAL PETROLEUM COMPANY, LTD.,**

330 Merchants National Bank Bldg.,  
Los Angeles, Cal. Lester H. Miles,  
President. Lester M. Gray, Secre-  
tary. June 29, 1917. \$9,600.

**R. T. OIL COMPANY,**

Care G. S. Thurman, Madera, Cal.  
W. B. Thurman, President. G. S.  
Thurman, Secretary. September 19,  
1910. \$150,000.

**\*RUBY OIL COMPANY, THE,**

1008 Security Bldg., Los Angeles, Cal.  
J. W. Jameson, President. George L.  
Reynolds, Secretary. February 13,  
1908. \$300,000. Ten wells, Kern  
County.

**\*SAFE OIL COMPANY,**

208 Brower Bldg., Bakersfield, Cal.  
C. A. Barlow, President. W. H. Hill,  
Secretary. March 1, 1907. \$100,000.  
Four wells, Kern County.

**SAFETY OIL COMPANY,**

Delger Bldg., Fourteenth and Broadway,  
Oakland, Cal. G. Erwin Brinckerhoff,  
President. M. V. Cooley, Secretary.  
March 8, 1901. \$300,000. Orig.; \$17,-  
500, Dec.

**\*SALT LAKE OIL COMPANY OF CALI-  
FORNIA,**

55 New Montgomery St., San Francisco,  
Cal. Wm. Sproule, President. P. G.  
Williams, Secretary. November 27,  
1903. \$500,000. One hundred seven  
wells, Los Angeles County.

**\*SALT MARSH CANON OIL COMPANY,**

P. O. Box 44, Santa Paula, Cal. A. M.  
Dunham, President. F. H. Dunham,  
Secretary. September 24, 1902. \$20,-  
000. Orig.; \$50,000 Inc. Five wells,  
Ventura County.

**\*SALVIA OIL COMPANY,**

1004 Security Bldg., Los Angeles, Cal.  
Thos. A. O'Donnell, President. Ellis  
T. Yarnell, Secretary. November 3,  
1915. \$10,000. Fourteen wells, Fresno  
County.

**SAMSONIAN OIL COMPANY,**

First National Bank Bldg., Oakland,  
Cal. Care H. B. Griffith. March 19,  
1917. \$25,000.

**SAN ANTONIO OIL AND LAND COM-  
PANY,**

348 Hayes St., San Francisco, Cal.  
James R. Little, President. A. W.  
Craig, Secretary. March 19, 1900.  
\$100,000.

**SAN BERNARDINO VALLEY OIL COM-  
PANY,**

San Bernardino, Cal. A. E. Perris,  
President. D. M. Perris, Secretary.  
December 2, 1912. \$25,000.

**SAN CARLOS OIL COMPANY,**

200 McAllister St., San Francisco, Cal.  
H. L. Funk, President. H. B. Hambly,  
Secretary. February 19, 1892. \$1,-  
000,000. Orig.; \$100,000. Dec.

**SAN DIEGO AND IMPERIAL VALLEY  
OIL COMPANY,**

American Bank Bldg., San Diego, Cal.  
Care Bernard & Malcomber. March  
21, 1917. \$25,000.

**SAN DIEGO AND TEXAS OIL COM-  
PANY,**

Care John J. Brennan, San Diego, Cal.  
July 15, 1918. \$200,000.

**\*SAN DIEGO CONSOLIDATED OIL  
COMPANY,**

Owl Drug Bldg., San Diego, Cal. P. M.  
Johnson, President. George H. Hughes,  
Secretary. May 3, 1915. \$500,000.  
Two wells, Orange County.

**SAN DIEGO OIL COMPANY,**

Care John F. McVean, 2637 Logan Ave.,  
San Diego, Cal. John F. McVean,  
President. H. C. Barnes, Secretary.  
October 28, 1916. \$50,000.

**\*SAN FRANCISCO AND McKITTRICK  
OIL COMPANY,**

607 Monadnock Bldg., San Francisco.  
Cal. H. U. Maxfield, President. Wal-  
ter C. Beatie, Secretary. December  
11, 1899. \$500,000. Seventeen wells,  
Kern County.

**SAN FRANCISCO AND WYOMING OIL  
COMPANY,**

67 Buena Vista Terrace, San Francisco,  
Cal. F. J. Baird, President. Wm. J.  
Drew, Secretary. August 15, 1913.  
\$200,000.

**\*SAN FRANCISCO MIDWAY OIL COM-  
PANY,**

660 Market St., San Francisco, Cal. G.  
F. Lyon, President. W. S. Oliver,  
Secretary. March 25, 1910. \$500,000.  
One well, Kern County.

**SAN FRANCISCO PETROLEUM COM-  
PANY,**

Room 401, 110 Market St., San Fran-  
cisco, Cal. March 22, 1918. \$1,000,000.

**SAN GABRIEL PETROLEUM COMPANY,**

1117 Title Insurance Bldg., Los Angeles,  
Cal. Care Goodwin & Mortgage.  
June 28, 1917. \$100,000. (Dissolved.)  
(Property operated by Petroleum Mid-  
way Co., Ltd.)

**SAN JUAN OIL COMPANY,**

1910 Mariposa St., Fresno, Cal. W. B.  
Holland, President. Ben Epstein,  
Secretary. March 5, 1909. \$25,000.  
Fresno County.

**\*SANTA CLARA OIL AND DEVELOP-  
MENT COMPANY,**

719 Story Bldg., Los Angeles, Cal. L. C.  
Throop, President. G. H. Kleinhans,  
Secretary. February 9, 1912. \$1,000,-  
000. One well, Ventura County.

**\*SANTA MARIA CRUDE OIL COMPANY,**

622 Bumiller Bldg., Los Angeles, Cal.  
W. V. Ambrose, President. Chas. F.  
Off, Secretary. December 29, 1906.  
\$500,000. One well, Ventura County.

**SANTA MARIA ENTERPRISE OIL COM-  
PANY,**

613 Hibernian Bank, Los Angeles, Cal.  
Care G. E. Bittinger, President.  
December 15, 1909. \$400,000.

**\*SANTA MARIA OIL FIELDS, INC.,**

Box 638, Santa Maria, Cal. Carroll W.  
Gates, President. Jay Spence, Secre-  
tary. March 14, 1916. \$2,250,000.  
Three wells, Santa Barbara County.

**\*SANTA PAULA OIL COMPANY,**

133 California St., San Francisco, Cal.  
Chas. W. Gardner, President. A. E.  
Boynton, Secretary. October 13, 1916.  
\$100,000. Two wells, Ventura County.

**SANTA PAULA Y SATICOY OIL COMPANY,**

319 Kohl Bldg., San Francisco, Cal.  
William Whitney, President. A. C.  
Hellman, Secretary. March 28, 1903.  
\$100,000.

**SANTA SUSANA OIL CORPORATION,**

1101 Hollingsworth Bldg., Los Angeles,  
Cal. I. H. Lehman, President. Hobart  
M. De Lanoie, Secretary. November  
30, 1917. \$3,000,000.

**\*SANTA SUSANA SYNDICATE,**

1201 Hollingsworth Bldg., Los Angeles,  
Cal. Dr. A. Hirschi, President.  
Eleven wells, Ventura County. (Property  
taken over by Santa Susana Oil  
Corporation.)

**SAUER DOUGH OIL COMPANY,**

510 Crocker Bldg., San Francisco, Cal.  
Geo. T. Cameron, President. R. A.  
Morton, Secretary. January 7, 1901.  
\$50,000. Fresno County.

**\*SCARAB OIL COMPANY,**

344 Fifth St., Oxnard, Cal. W. L. Dunn,  
President. H. R. Staples, Secretary.  
March 1, 1909. \$100,000. One well,  
Ventura County. (Property of Union  
Oil Company; pumped by Scarab Oil  
Company on royalty.)

**SEABOARD OIL AND TRANSIT COMPANY,**

1101 Story Bldg., Los Angeles, Cal. C.  
L. Flack, President. A. F. Clark,  
Secretary. December 28, 1911. \$1,-  
000,000.

**\*SEASIDE OIL COMPANY,**

310 Sansome St., San Francisco, Cal.  
H. J. Hart, President. L. C. Cook,  
Secretary. February 24, 1898. \$200,000.  
Orig.; \$10,000 Dec. Eleven wells,  
Santa Barbara County.

**\*SECTION FIVE OIL COMPANY,**

255 Holbrook Bldg., San Francisco, Cal.  
F. L. Lezinsky, President. S. G. O.  
King, Secretary. December 3, 1900.  
\$75,000, Orig.; \$150,000, Inc. Eight  
wells, Kern County.

**SECTION ONE OIL COMPANY,**

502 Balboa Bldg., San Francisco, Cal.  
Care O. G. Meyers, Secretary. T. A.  
O'Donnell, President. August 14, 1907.  
\$10,000.

**\*SECTION SEVEN OIL COMPANY,**

607 First National Bank Bldg., San  
Francisco, Cal. W. J. Boiner, Presi-  
dent. H. E. Sherbley, Secretary.  
June 26, 1905. \$300,000. Four wells,  
Fresno County.

**\*SECTION TEN OIL COMPANY,**

Ben Williams, President. Coalinga, Cal.  
One well, Fresno County.

**SECTION THREE OIL COMPANY,**

Care G. S. Thurman, Madera, Cal. W.  
B. Thurman, President. G. S. Thur-  
man, Secretary. February 23, 1911.  
\$150,000.

**SECTION TWELVE OIL COMPANY,**

Care Jordan & Jordan, Bakersfield, Cal.  
April 4, 1911. \$50,000.

**\*SECTION TWENTY-FIVE OIL COMPANY,**

208 Brower Bldg., Bakersfield, Cal. T.  
E. Sullivan, President. C. A. Barlow,  
Secretary. September 28, 1903. \$40,000.  
Thirty-two wells, Kern County.

**\*SECURITY DEVELOPMENT COMPANY,**

P. O. Box 813, Bakersfield, Cal. E. D.  
Burge, President. C. H. Franey, Sec-  
retary. April 29, 1913. \$50,000. Nine  
wells, Kern County.

**SECURITY OIL COMPANY,**

1004 Title Insurance Bldg., Los Angeles,  
Cal. Care E. A. Hawkins, Secretary.  
O. C. Edwards, President. October 19,  
1916. \$200,000. Kern County.

**\*SENECA OIL COMPANY,**

1133 Divisadero St., Fresno, Cal. Geo.  
L. Warlow, President. W. T. Knowles,  
Secretary. April 20, 1908. \$250,000.  
Six wells, Fresno County.

**\*SESNON OIL COMPANY,**

58 Sutter St., San Francisco, Cal. W.  
T. Sesnon, President. G. W. Fanning,  
Secretary. February 17, 1908. \$100,-  
000. Fifteen wells, Kern County.

**\*SHANDON OIL COMPANY,**

P. O. Box 400, Caldwell, N. J. Alex-  
ander Dallas, President. P. Beaton,  
Secretary. February 19, 1913. \$750,-  
000. Fresno County.

**SHAW RANCH OIL COMPANY,**

Box 638, Santa Maria, Cal. Oliver C.  
Edwards, President. Jay Spence, Sec-  
retary. September 18, 1912. \$2,000,000.  
Santa Barbara County.

**\*SHELL COMPANY OF CALIFORNIA,**

343 Sansome St., San Francisco, Cal.  
W. Meischke-Smith, President. R. A.  
Lewin, Secretary. July 30, 1915.  
\$45,000,000. Two wells, Ventura  
County; 232 wells, Fresno County.

**SHIRLEY OIL COMPANY,**

421 N. Main St., Santa Ana, Cal. John  
W. Shirley, President. J. G. Quick,  
Secretary. January 7, 1903. \$10,000.

**SHREEVES OIL COMPANY, THE,**

55 New Montgomery St., San Francisco,  
Cal. Wm. Sproule, President. P. G.  
Williams, Secretary. July 26, 1906.  
\$200,000. (Dissolved.)

**SIBYL OIL COMPANY,**

1003 Higgins Bldg., Los Angeles, Cal.  
J. W. Maddrill, President. C. R.  
Stevens, Secretary. October 11, 1909.  
\$50,000. Kern County.

**SILVER TIP OIL COMPANY,**

923-924 Van Nuys Bldg., Los Angeles,  
Cal. S. A. Guiberson, Jr., President.  
E. L. Sargent, Asst. Secretary.  
February 25, 1909. \$750.

**\*SLOCUM, THOS. A.,**

543 Bradbury Bldg., Los Angeles, Cal.  
Ten wells, Ventura County. (Operat-  
ing as Slocum & Company.)

**\*SNOOK, WALTER,**

Maricopa, Cal. Four wells, Kern  
County.

**SOUTH COAST OIL COMPANY,**

349 Rialto Bldg., San Francisco, Cal.  
James Casey, President. A. J. Porter, Secretary. July 10, 1913.  
\$1,000,000.

**SOUTHEASTERN LIMITED OIL COMPANY,**

Room 637, 58 Sutter St., San Francisco, Cal. Louis Nathan, President. Chas. G. Wilcox, Secretary. September 30, 1908. \$500,000.

**\*SOUTHERN CALIFORNIA EDISON COMPANY,**

120 East Fourth St., Los Angeles, Cal. W. A. Brackenridge, President. S. M. Kennedy, Secretary. July 6, 1909. \$100,000,000. Forty wells, Los Angeles County.

**\*SOUTHERN CALIFORNIA GAS COMPANY,**

809 Garland Bldg., Los Angeles, Cal. Wm. G. Kerckhoff, President. L. M. Farnham, Secretary. October 3, 1910. \$10,000,000. Seven wells, Kern County.

**SOUTHERN CALIFORNIA OIL SYNDICATE, LTD.,**

Bank of Lompoc Bldg., Lompoc, Cal. Care W. J. Packard. April 23, 1907. \$25,000.

**\*SOUTHERN PACIFIC COMPANY,**

65 Market St., San Francisco, Cal. Wm. Sproule, President. A. D'Heur, Manager, Fuel Oil Department. One hundred thirty-nine wells, Fresno County; 446 wells, Kern County.

**SOUTHERN PETROLEUM COMPANY OF CALIFORNIA, THE,**

1113 Hibernian Bldg., Los Angeles, Cal. Care Lyle W. Rucker. January 7, 1918. \$1,000,000.

**SOUTH MIDWAY OIL COMPANY,**

418 Chamber of Commerce Bldg., Los Angeles, Cal. Julius Fried, President. W. W. Worthing, Secretary. April 15, 1910. \$1,000,000.

**SOUTH MOUNTAIN OIL COMPANY,**

435 Security Bldg., Los Angeles, Cal. R. Mansard, President. A. L. Jamison, Secretary. October 20, 1913. \$300,000.

**\*SOUTH PACIFIC OIL COMPANY,**

637 Consolidated Realty Bldg., Los Angeles, Cal. A. I. Smith, Manager. Twelve wells, Ventura County. (Co-partnership.)

**\*SOVEREIGN OIL COMPANY,**

585 Market St., San Francisco, Cal. Wm. Ellery, President. J. W. Ellery, Secretary. October 15, 1900. \$500,000. Eleven wells, Kern County.

**\*SPELLACY & THOMPSON,**

1 W. Hellman Bldg., Los Angeles, Cal. Kern County.

**\*SPINKS CRUDE OIL COMPANY,**

P. O. Box 598, Monrovia, Cal. Wm. A. Spinks, President. Walter F. Dunn, Secretary. November 3, 1909. \$200,000. Eight wells, Fresno County.

**SPOCO OIL COMPANY OF LOS ANGELES,**

Care O'Melveny, Milliken & Fuller, 825 Title Insurance Bldg., Los Angeles, Cal. February 21, 1918. \$75,000.

**S. P. PLACER MINING COMPANY,**

1511 Eighteenth St., Bakersfield, Cal. T. E. Collins, President. Fred Gunther, Secretary. September 8, 1899. \$200,000.

**\*SPRECKELS OIL COMPANY,**

60 California St., San Francisco, Cal. J. D. Spreckels, Jr., President. G. B. Waterman, Secretary. November 1, 1911. \$200,000. Four wells, Kern County.

**SQUAW FLAT OIL COMPANY,**

401 Union Oil Bldg., Los Angeles, Cal. A. J. Aber, President. B. M. Howe, Secretary. August 11, 1910. \$200,000.

**\*STANDARD OIL COMPANY,**

Standard Oil Bldg., San Francisco, Cal. W. S. Rheem, President. H. M. Storey, Secretary. September 10, 1879. \$100,000,000. One hundred thirty-three wells, Fresno County; 451 wells, Kern County; 152 wells, Los Angeles County; 50 wells, Orange County.

**STAR NEWHALL OIL COMPANY,**

Care Jacob Weinberger, 513 American National Bank Bldg., San Diego, Cal. September 28, 1918. \$50,000.

**\*STATE CONSOLIDATED OIL COMPANY,**

912 Baker-Detwiler Bldg., Los Angeles, Cal. E. J. Miley, President. A. M. Buley, Secretary. March 3, 1911. \$1,250,000. One well, Ventura County; 32 wells, Kern County.

**STATE OIL COMPANY OF CALIFORNIA,**

310 Sansome St., San Francisco, Cal. John Barneson, President. J. Leslie Barneson, Secretary. February 15, 1910. \$200,000.

**\*STAUFFER OIL COMPANY,**

621 California St., San Francisco, Cal. C. de Guigne, President. C. Jantzen, Secretary. May 19, 1909. \$100,000. Six wells, Kern County.

**\*STEPHENS DRILLING ACCOUNT,**

Merchants National Bank Bldg., Los Angeles, Cal. Moye W. Stephens, Manager. One well, Los Angeles County.

**\*STERLING OIL AND DEVELOPMENT COMPANY,**

55 New Montgomery St., San Francisco, Cal. Alden Anderson, President. P. G. Williams, Secretary. October 30, 1899. \$250,000. Forty-one wells, Kern County.

**\*ST. HELENS PETROLEUM COMPANY, LTD., THE,**

1117 L. A. Investment Bldg., Los Angeles, Cal. H. H. Haddin, Chairman. R. H. Young, Secretary. R. W. Stephens, Los Angeles, Secretary. May 10, 1913. \$1,200,000. Twenty-five wells, Kern County; 13 wells, Orange County.

**\*ST. LAWRENCE OIL COMPANY,**

411 Montgomery St., San Francisco, Cal. I. Strassburger, President. A. E. Cole, Secretary. April 14, 1908. \$100,000. Seven wells, Kern County.

**\*STOCKTON MIDWAY OIL COMPANY,**

309 E. Main St., Stockton, Cal. Geo. F. Hudson, President. C. F. Campbell, Secretary. December 8, 1910. \$1,000,000. Five wells, Kern County.

**\*ST. PAUL CONSOLIDATED OIL COMPANY,**

Farmers National Bank Bldg., Fresno, Cal. Geo. L. Warlow, President. W. T. Knowles, Secretary. September 24, 1910. \$600,000. Seven wells, Fresno County.

**ST. PAUL-FRESNO OIL COMPANY,**

1133 Divisadero St., Fresno, Cal. Geo. L. Warlow, President. W. T. Knowles, Secretary. June 5, 1903. \$250,000.

**\*STRONG OIL COMPANY,**

1015 Marsh-Strong Bldg., Los Angeles, Cal. Frank P. Strong, Three wells, Fresno County. (Co-partnership.) (From June to August, 1918, property operated by Harris & Cates. From September, 1918, property operated by C. B. Cates Co.)

**SURGEON OIL COMPANY,**

Care J. A. Turner, Santa Ana, Cal. J. A. Turner, President. I. D. Mills, Secretary. January 11, 1901. \$300,000. Orig.; \$50,000, Dec. Kern County.

**SUBMARINE OIL COMPANY,**

Box 477, Santa Barbara, Cal. R. H. Herron, President. F. I. Herron, Secretary. August 25, 1917. \$25,000.

**SUCCESSUS OIL COMPANY,**

1526-32 Twentieth St., Bakersfield, Cal. Louis V. Olcese, President. Gus. Schamblin, Secretary. October 6, 1911. \$150,000. Kern County.

**\*SUDDEN & EMSLIE,**

Care R. C. Sudden, Ventura, Cal. Three wells, Ventura County.

**SUDDEN OIL COMPANY,**

Lompoc, Cal. T. F. Fox, President. John C. Lind, Secretary. March 5, 1910. \$300,000.

**SULLIVAN, Wm.**

San Gabriel, Cal. One well, Los Angeles City.

**SULPHUR MOUNTAIN PETROLEUM COMPANY,**

Fullerton, Cal. Wm. Starbuck, President. July 13, 1900. \$800,000.

**SUNBEAM OIL COMPANY,**

724 Trust & Savings Bldg., Los Angeles, Cal. R. B. Blodget, President. Nichols Milbank, Secretary. July 17, 1916. \$100,000. Kern County.

**\*SUNCREST OIL COMPANY,**

617 Merritt Bldg., Los Angeles, Cal. Burton E. Green, President. F. B. Sutton, Secretary. September 5, 1916. \$50,000. One well, Kern County.

**SUNPARK OIL COMPANY,**

617 Merritt Bldg., Los Angeles, Cal. Burton E. Green, President. F. B. Sutton, Secretary. December 19, 1910. \$100,000.

**\*SUNSET EXTENSION OIL COMPANY,**

Garland Bldg., Los Angeles, Cal. Harry M. Wier, President. Geo. E. Mills, Secretary. May 23, 1910. \$300,000. One well, Kern County.

**\*SUNSET MONARCH OIL COMPANY,**

60 California St., San Francisco, Cal. G. P. Ayers, President. Geo. A. Douglass, Secretary. December 10, 1906. \$500,000. Kern County. (Property leased to Standard Oil Company, February 14, 1917.)

**SUNSET OIL COMPANY, THE,**

26 W. Arallaga St., Santa Barbara, Cal. F. A. Conant, President. Y. C. Hassinger, Secretary. June 21, 1899. \$50,000. Kern County.

**SUNSET ROAD OIL COMPANY,**

Box 478, Maricopa, Cal. John Bennett, President. E. R. Hough, Secretary. June 22, 1905. \$2,500,000. Kern County.

**SUNSET VENTURA OIL COMPANY,**

Care Ogden & Esteb, 711 American Bank Bldg., Los Angeles, Cal. March 11, 1918. \$300,000.

**SUNSHINE OIL COMPANY,**

Woodland, Cal. Care J. M. Day. July 15, 1910. \$150,000.

**SURF OIL COMPANY,**

1114 Union Oil Bldg., Los Angeles, Cal. W. L. Stewart, President. John McPeak, Assistant Secretary. December 19, 1902. \$500,000.

**SUSSEX OIL COMPANY,**

Room 411, 332 Pine St., San Francisco, Cal. F. E. Fitzpatrick, President. Edward Fox, Secretary. November 11, 1910. \$2,500.

**\*S. W. & B. OIL COMPANY,**

622 Merchants Exchange Bldg., San Francisco, Cal. A. D. King, Vice President. V. B. Fletcher, Secretary. March 23, 1904. \$400,000. Five wells, Fresno County.

**SWAN OIL COMPANY,**

Visalia, Cal. H. Jerusalem, Secretary. January 8, 1900. \$15,000.

**SYNDICATE OIL COMPANY,**

San Luis Obispo, Cal. E. W. Clark, President. P. M. Gregg, Secretary. March 18, 1905. \$250,000.

**SYNDICATE PETROLEUM COMPANY,**

424 W. Thirty-eighth St., New York. N. Y. Care Manhattan Soap Company. Oscar M. Burke, President. E. E. Helyer, Secretary. March 26, 1912. \$50,000. Kern County.

**\*TAMALPAIS OIL COMPANY,**

149 California St., San Francisco, Cal. E. A. Bunker, President. F. F. Bostwick, Secretary. March 31, 1910. \$500,000. Three wells, Kern County.

**\*TANNEHILL OIL COMPANY,**

1815 Cherokee Ave., Hollywood, Cal. L. B. Tannehill, President. C. C. Tannehill, Secretary. February 4, 1909. \$250,000. Eleven wells, Kern County.

**TAPO OIL COMPANY,**

Santa Paula, Cal. S. G. Graham, President. Allan C. McKevitt, Secretary. April 27, 1900. \$1,000,000.

**TARR & McCOMB,**

1025 Central Bldg., Los Angeles, Cal.

**TECUMSEH PETROLEUM COMPANY,**

Spreckels Bldg., San Diego, Cal. W. H. V. Egan, President. A. J. Razeto, Secretary. February 2, 1918. \$225,000.

**\*TEJON OIL COMPANY,**

P. O. Box 271, Bakersfield, Cal. H. R. Peacock, President. Peter McCart, Secretary. November 9, 1908. \$20,000. Six wells, Kern County.

**TEMPLE OIL COMPANY,**

909 Title Insurance Bldg., Los Angeles, Cal. F. C. van Deinsse, President. R. J. Pagen, Secretary. July 30, 1892. \$60,000.

**THETA OIL AND LAND COMPANY,**

260 California St., San Francisco, Cal. Donald Y. Campbell, President. W. C. de Fremery, Secretary. February 20, 1900. \$48,380. Kern County.

**36 OIL COMPANY,**

Room 3, Farmers National Bank Bldg., Fresno, Cal. E. E. Manheim, President. Geo. L. Warlow, Secretary. December 24, 1900. \$500,000.

**THIRTY THIRTY TWO LAND COMPANY,**

1008 Security Bldg., Los Angeles, Cal. J. M. Danziger, President. Geo. L. Reynolds, Secretary. December 8, 1910. \$8,500.

**32 OIL COMPANY,**

911 Investment Bldg., Los Angeles, Cal. W. C. Price, President. W. R. Wheat, Secretary. December 14, 1908. \$10,000.

**JOHN THOMAS OIL COMPANY,**

82 Temple Block, Los Angeles, Cal. H. Clay Needham, President. James H. Blanchard, Secretary. August 6, 1900. \$336,000.

**THREE TWENTY OIL COMPANY,**

907 Wilson St., Fresno, Cal. M. R. Maclary, Vice President. F. G. Story, Secretary. March 23, 1910. \$500,000.

**TIA JUANA VALLEY OIL COMPANY,**

323 Timken Bldg., San Diego, Cal. September 16, 1910. \$70,000.

**\*TIBER PACIFIC OIL COMPANY,**

412 Bumiller Bldg., Los Angeles, Cal. J. M. Roberts, President. A. L. Ellis, Secretary. August 5, 1914. \$325,000. Six wells, San Luis Obispo County.

**TIDAL WAVE OIL COMPANY,**

Care G. W. Glines, 2306 Second St., Selma, Cal. T. B. Matthews, Vice President. G. W. Glines, Secretary. July 22, 1899. \$25,000.

**TIGER OIL COMPANY,**

820 Hearst Bldg., San Francisco, Cal. Frank V. Bell, President. Arthur McNamara, Secretary. January 11, 1918. \$10,000.

**TIMBER CANYON OIL COMPANY,**

Care D. H. Lanbershelmer, 231 Security Bldg., Los Angeles, Cal. August 2, 1918. \$100,000. (Formerly Timber Canyon Syndicate.)

**TITICACA OIL COMPANY,**

617 Merritt Bldg., Los Angeles, Cal. Chester W. Brown, President. F. B. Sutton, Secretary. May 11, 1905. \$1,000,000.

**TITUS, LOUIS,**

Flatiron Bldg., San Francisco, Cal. One well, San Luis Obispo County. (Now being abandoned.)

**\*TOPAZ OIL COMPANY,**

Box 34, Bakersfield, Cal. A. J. Woody, President. F. A. Young, Secretary. June 25, 1908. \$20,000. Two wells, Kern County.

**TOP KNOT OIL COMPANY,**

421 N. Main St., Santa Ana, Cal. A. D. Bishop, President. A. J. Visel, Secretary. October 5, 1900. \$200,000. Kern County. (Dissolved.)

**TORREY CAÑON OIL COMPANY,**

1232 Merchants Exchange Bldg., San Francisco, Cal. C. B. Wingate, President. G. M. Murphy, Secretary. July 1, 1910. \$200,000.

**TOWSLEY CAÑON OIL COMPANY,**

1122 Investment Bldg., Los Angeles, Cal. J. D. Coplen, President. J. H. Borders, Secretary. July 16, 1915. \$25,000.

**\*TRADERS OIL COMPANY,**

616 Union Oil Bldg., Los Angeles, Cal. M. V. McQuigg, President. A. J. Wallace, Secretary. July 13, 1907. \$1,500,000. Twenty-five wells, Fresno County; 27 wells, Kern County.

**TRADERS OIL CORPORATION,**

616 Union Oil Bldg., Los Angeles, Cal. M. V. McQuigg, President. April 3, 1918. \$8,500,000.

**\*TRAFFIC OIL COMPANY,**

616 Union Oil Bldg., Los Angeles, Cal. M. V. McQuigg, President. A. J. Wallace, Secretary. April 12, 1910. \$2,500,000. Sixteen wells, Kern County.

**\*TREASURE OIL AND REALTY COMPANY,**

Care T. R. Finley, Santa Maria, Cal. Santa Barbara County.

**TRES SIERRITAS OIL AND MINING COMPANY,**

P. O. Box 505, Lemoore, Cal. John McGlashan, President. Edward P. Ammerman, Secretary. October 21, 1899. \$60,000.

**TRI-STATE OIL COMPANY,**

La Habra, Cal. F. G. Phillips, President. E. B. Coil, Secretary. March 13, 1912. \$500,000.

**\*TROJAN OIL COMPANY,**

401 Union Oil Bldg., Los Angeles, Cal. A. J. Aber, President. B. M. Howe, Secretary. May 19, 1914. \$500,000. One well, Kern County.

**TRUE OIL COMPANY, THE,**

714 Story Bldg., Los Angeles, Cal. D. C. Narver, President. E. E. Prime, Secretary. February 23, 1917. \$3,000,000.

**TULARE OIL AND MINING COMPANY,**

115 N. K St., Tulare, Cal. L. E. Schoenemann, President. C. W. Cobb, Secretary. November 1, 1890. \$300,000. Kern County.

**\*TUMBADOR OIL COMPANY,**

1112 Merchants National Bank Bldg., San Francisco, Cal. W. F. Williamson, President. E. M. Eddy, Secretary. May 5, 1910. \$500,000. Thirteen wells, Kern County.

**\*TUNNEL PETROLEUM COMPANY,**

805 Hollingsworth Bldg., Los Angeles,  
Cal. F. R. Campbell, President. H. A.  
Dunn, Secretary. April 28, 1916.  
\$250,000. One well, Ventura County.

**TURNER OIL COMPANY (Los Angeles),**

Box 144, Arcade Station, Los Angeles,  
Cal. G. L. Holton, President. Robt.  
G. Holton, Secretary. June 14, 1899.  
\$150,000.

**TURNER OIL COMPANY (San Francisco),**

180 Sutter St., San Francisco, Cal.  
Joseph Seeley, President. J. W. Pauson,  
Secretary. November 5, 1904.  
\$50,000. Fresno County.

**\*T. W. COMPANY,**

Box 34, Bakersfield, Cal. T. M. Young,  
President. G. R. Peckham, Secretary.  
March 12, 1909. \$100,000. Five wells,  
Kern County.

**TWENTIETH CENTURY OIL COMPANY,**

1156 J St., Fresno, Cal. C. A. Telfer,  
Secretary. W. O. Miles, President.  
October 25, 1900. \$200,000.

**TWENTY-FOUR OIL COMPANY,**

Box 823, Fresno, Cal. Geo. Kaehler,  
President. A. Buttner, Secretary.  
December 1, 1909. \$24,000.

**TWIN CITIES OIL COMPANY,**

221 Broad St., Nevada City, Cal. C. E.  
Clinch, President. D. E. Morgan,  
Secretary. May 20, 1901. \$250,000,  
Orig.; \$10,000 Dec.

**UNION ANNEX OIL COMPANY,**

1210 Washington Bldg., Los Angeles,  
Cal. J. S. Torrance, President. February  
24, 1903. \$1,000,000.

**UNION KERN OIL COMPANY,**

545 I. W. Hellman Bldg., Los Angeles,  
Cal. July 30, 1910. \$1,000,000.

**\*UNION OIL COMPANY OF CALIFORNIA,**

Union Oil Bldg., Los Angeles, Cal. W.  
L. Stewart, President. John McPeak,  
Secretary. October 17, 1890. \$5,000,000,  
Orig.; \$50,000,000 Inc. Twenty-two  
wells, Fresno County; 34 wells, Kern  
County; 1 well, Los Angeles County;  
80 wells, Orange County; 82 wells,  
Ventura County; 168 wells, Santa Barbara  
County.

**\*UNITED CRUDE OIL COMPANY, THE,**

Drawer "O", Bakersfield, Cal. E. H.  
Loveland, President. C. H. Burdick,  
Secretary. August 16, 1908. \$500,-  
000. Four wells, Kern County.

**UNITED DEVELOPMENT COMPANY,**

Box 187, Coalinga, Cal. O. D. Loftus,  
President. Guy H. Salisbury, Secretary.  
September 21, 1909. \$45,000.

**UNITED MIDWAY OIL COMPANY,**

Box 337, Visalia, Cal. J. C. Newman,  
President. C. E. Groat, Secretary.  
March 5, 1910. \$100,000. Kern County.

**\*UNITED OIL COMPANY, THE,**

1131 Investment Bldg., Los Angeles,  
Cal. C. F. Whittier, President. K.  
E. Steinbauer, Secretary. November  
19, 1909. \$2,000,000. Twelve wells,  
Kern County.

**U. S. OIL AND MINING COMPANY,**

Box 246, Bakersfield, Cal. Martin  
Coyne, President. L. Hirshfeld, Secretary.  
December 23, 1899. \$300,000.

**U. S. OIL REFINING AND PRODUCTION COMPANY,**

305 Hobart Bldg., San Francisco, Cal.  
J. C. Kemp van Ee, President. P. F.  
Unger, Secretary. January 27, 1910.  
\$1,000,000.

**\*UNITED WESTERN CONSOLIDATED OIL COMPANY,**

Hobart Bldg., San Francisco, Cal. A. G.  
Wilkes, President. Fred Shingle,  
Secretary. May 1, 1917. \$3,000,000.  
Sixteen wells, Kern County; 1 well,  
Santa Barbara County.

**UNITED WESTERN OIL COMPANY,**

705 Hobart Bldg., San Francisco. John  
McKeon, President. A. B. Kast, Secretary.  
April 12, 1916. \$500,000.

**\*UNIVERSAL OIL COMPANY,**

510 Crocker Bldg., San Francisco, Cal.  
R. N. Bishop, President. R. A. Morton,  
Secretary. April 27, 1911. \$6,-  
000,000. Forty-four wells, Kern  
County; 3 wells, Fresno County.

**VALLEY OIL COMPANY,**

Care J. A. Fleutsch, Coalinga, Cal. S.  
W. Morshead, President. J. A.  
Fleutsch, Secretary. February 18,  
1909. \$100,000.

**VANCOUVER MIDWAY OIL COMPANY,**

310 Sansome St., San Francisco, Cal.  
A. L. Weil, President. M. Syme, Secretary.  
January 10, 1911. \$100,000.  
Kern County.

**VANDERLIP OIL COMPANY,**

114 E Fourth St., Santa Ana, Cal. Geo.  
A. Edgar, President. H. C. Vanderlip,  
Secretary. February 16, 1901.  
\$200,000. Kern County.

**\*VENTURA-PACIFIC OIL COMPANY,**

412 Owl Drug Bldg., San Diego, Cal.  
F. E. Wisecup, President. E. G.  
Dehm, Secretary. October 18, 1912.  
\$225,000. Five wells, Ventura County.

**VERA CRUZ OIL COMPANY,**

1101 Story Bldg., Los Angeles, Cal. Wm.  
Perry, President. A. F. Clark, Secretary.  
November 19, 1915. \$100,000.

**VERATINA OIL COMPANY,**

348 Hayes St., San Francisco, Cal. A.  
W. Craig, Secretary. February 27,  
1901. \$150,000.

**\*VESTA OIL COMPANY,**

Room 421, 607 S. Hill St., Los Angeles,  
Cal. Geo. F. Freeman, President. L.  
Schenck, Secretary. August 7, 1900.  
\$300,000. Eleven wells, Kern County.

**\*VICTOR OIL COMPANY,**

1109 I. N. Van Nuys Bldg., Los Angeles,  
Cal. H. D. Colson, President. Frank  
C. Winter, Secretary. March 30,  
1910. \$500,000. Five wells, Kern  
County.

**VICTORIA OIL COMPANY,**

1036 Andrews Bldg., Minneapolis, Minn.  
Charles Murray, President. E. J.  
Murray, Secretary. November 30,  
1914. \$50,000.

- \*VIRGINIA OIL COMPANY,**  
Box 655, Los Angeles, Cal. Albert Brown, President. J. B. Kessinger, Secretary. May 26, 1914. \$25,000. Thirty wells, Kern County.
- \*VISALIA MIDWAY OIL COMPANY,**  
110 S. Court St., Visalia, Cal. E. L. Smith, President. Geo. D. Smith, Secretary. March 9, 1901. \$500,000. Seven wells, Kern County.
- VISALIA OIL COMPANY,**  
626 S. Garden St., Visalia, Cal. Louis Lucier, President. Otto Lohdorff, Secretary. April 13, 1914. \$100,000. Kern County.
- VISHNU OIL COMPANY,**  
300 Crocker Bldg., San Francisco, Cal. W. Gregg, Jr., President. W. R. Berry, Secretary. June 20, 1900. \$500,000.
- \*VOLCAN OIL AND REFINING COMPANY,**  
First and I Sts., P. O. Box 83, San Diego, Cal. H. N. Goff, President. G. F. Nolan, Secretary. January 24, 1902. \$550,000. Seven wells, Kern County.
- WABASH OIL COMPANY,**  
310 Sansome St., San Francisco, Cal. John Barneson, President. W. J. Dinsmore, Secretary. April 14, 1903. \$300,000, Orig.; \$15,000, Dec.
- WALKER OIL COMPANY,**  
Care J. A. Fluetsch, 305 Fifth St., Coal- inga, Cal. O. S. Axtell, Vice President. J. A. Fluetsch, Secretary. November 1, 1909. \$300,000.
- \*W. & S. OIL COMPANY,**  
1112 Merchants National Bank Bldg., San Francisco, Cal. W. F. William- son, President. D. E. Gunn, Secre- tary. May 11, 1911. \$200,000. Three wells, Kern County. (Property leased to the Potter Oil Company of Cali- fornia, September, 1917.)
- \*WARD OIL COMPANY,**  
Room 3, Farmers National Bank Bldg., Fresno, Cal. Geo. L. Warlow, Presi- dent. Chester H. Warlow, Secretary. November 15, 1907. \$100,000. Eight wells, Fresno County.
- \*WASHINGTON COALINGA OIL COM- PANY,**  
Care Harry Dalton, 601 Foster Bldg., Denver, Colo. Fresno County.
- \*WATSONVILLE OIL COMPANY,**  
339 Main St., Watsonville, Cal. M. B. Tuttle, President. A. W. Cox, Secre- tary. December 15, 1896. \$100,000, Orig.; \$200,000 Inc. Five wells, Santa Clara County.
- \*WELCH, P.,**  
Maricopa, Cal. Two wells, Kern County.
- WELCOME OIL COMPANY,**  
78 Bacon Bldg., Oakland, Cal. J. J. Enos, President. Frank Rogers, Secre- tary. October 14, 1909. \$200,000.
- \*WESCO PETROLEUM COMPANY,**  
502 Merritt Bldg., Los Angeles, Cal. D. J. Gouyer, President. Five wells, Kern County.
- WEST AMERICAN OIL COMPANY,**  
Care S. W. Waterhouse, 474 N. First St., San Jose, Cal. S. W. Waterhouse, President. Annie C. Waterhouse, Secretary. September 2, 1914. \$25,- 000. (Dissolved.)
- \*WEST COAST OIL COMPANY,**  
55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. June 23, 1908. \$5,000,000. Ten wells, Los Angeles County; 51 wells, Orange County.
- WESTERN MINERALS COMPANY,**  
704 West Coast Life Bldg., 354 Pine St., San Francisco, Cal. H. L. Tevis, President. F. G. Drum, Secretary. December 14, 1899. \$100,000.
- WESTERN OIL AND GAS COMPANY, LTD.,**  
511 Hutton Bldg., Spokane, Wash. John M. Downs, President. L. M. Weaver, Secretary. February 14, 1917. \$150,- 000.
- WESTERN OIL COMPANY,**  
2479 East Ninth St., Los Angeles, Cal. F. P. W. Hill, President. G. Zeeman, Secretary. April 15, 1912. \$10,000.
- \*WESTERN UNION OIL COMPANY,**  
Southern California Savings Bank Bldg., 4th and Spring Sts., Los Angeles. A. H. Braly, President. Morris Albee, Secretary. April 19, 1900. \$1,000,000. Forty wells, Santa Barbara County.
- \*WEST PENN COMPANY, INC., THE,**  
Brower Bldg., Bakersfield, Cal. F. L. Bartlett, President. F. L. Stowell, Secretary. (Dissolved.) (Property now operated by Potter Oil Co. of Cal.)
- \*WESTSIDE OIL COMPANY,**  
608 Grosse Bldg., Los Angeles, Cal. M. A. Robinson, President. Lester L. Robinson, Secretary. December 7, 1908. \$100,000. Three wells, Kern County.
- WEST SLOPE OIL COMPANY,**  
300 E Main St., Visalia, Cal. C. J. Gid- dings, President. J. Sub Johnson, Secre- tary. June 1, 1911. \$1,000,000.
- WEST STATES PETROLEUM COM- PANY,**  
Hobart Bldg., San Francisco, Cal. April 17, 1917. \$1,000,000. (Property sold to United Western Consolidated Oil Com- pany.)
- WHITE ROCK PETROLEUM COMPANY,**  
1386 Seventh Ave., San Francisco, Cal. W. I. Sterett, President. A. A. Cohn, Secretary. November 18, 1911. \$300,- 000.
- \*WHITE STAR OIL COMPANY,**  
510 Trust & Savings Bldg., Los Angeles, Cal. Richard Arenz, President. Chas. E. Putnam, Secretary. February 8, 1909. \$1,000,000. Seven wells, Ventura County.
- WHITLEY, C. W.,**  
825 Security Bldg., Los Angeles, Cal. One well, Los Angeles County.
- WHITTIER CONSOLIDATED OIL COM- PANY,**  
1004 Security Bldg., Los Angeles, Cal. T. A. O'Donnell, President. Ellis T. Yarnell, Secretary. June 7, 1900. \$1,000,000.

**\*WHITTIER CRUDE OIL COMPANY,**  
200 S. Los Angeles St., Los Angeles,  
Cal. L. D. Sale, President. H. G. A.  
Lovell, Secretary. January 22, 1900.  
\$300,000. Seven wells, Los Angeles  
County.

**WHITTIER OIL AND DEVELOPMENT  
COMPANY,**  
104 W. Philadelphia St., Whittier, Cal.  
C. W. Clayton, President. S. W.  
Barton, Secretary. May 31, 1900.  
\$250,000.

**\*WILBERT OIL COMPANY, THE,**  
1704 Nineteenth St., Bakersfield, Cal.  
H. A. Jastro, President. F. G. Mun-  
zer, Secretary. September 18, 1907.  
\$125,000. Eight wells, Kern County.

**WILCOX OIL COMPANY,**  
9 Main St., San Francisco, Cal. Chas.  
G. Wilcox, President. A. N. Baldwin,  
Secretary. February 21, 1911. \$1,000,000.

**WILKES HEAD OIL COMPANY,**  
705 Hobart Bldg., San Francisco, Cal.  
Thomas Wilkes, President. A. B.  
Kast, Secretary. November 2, 1913.  
\$300,000.

**\*H. S. WILLIAMS OIL COMPANY,**  
112 Market St., San Francisco, Cal.  
H. S. Williams, President. John Lee,  
Jr., Secretary. March 30, 1916. \$25,000.  
Five wells, Kern County. (Dissolved.)  
(Property taken over by Pacific Crude  
Oil Company.)

**WILLIAMS, H. S.**  
112 Market St., San Francisco, Cal.

**WILSHIRE OIL COMPANY,**  
Twenty-seventh St. and Santa Fe Ave.,  
Los Angeles, Cal. George S. Machris,  
President. Victor A. Machris, Secre-  
tary. August 30, 1917. \$250,000.

**W. J. OIL COMPANY,**  
Care E. F. Coons Bakersfield, Cal. S. P.  
Wible, President. Edith F. Coons,  
Secretary. October 23, 1908. \$25,000.  
Kern County.

**W. K. OIL COMPANY,**  
180 Sutter St., San Francisco, Cal. John  
Hinkel, President. J. W. Pauson,  
Secretary. December 8, 1904. \$25,000.  
Fresno County.

**\*W. M. AND M. OIL COMPANY, THE,**  
Box 501, Fresno, Cal. M. L. Woy,  
President. D. C. Sample, Secretary.  
November 17, 1909. \$100,000. Four  
wells, Fresno County.

**\*W. T. & M. COMPANY,**  
Box 34, Bakersfield, Cal. T. M. Young,  
President. G. R. Peckham, Secretary.  
April 19, 1909. \$500,000. Six wells,  
Kern County.

**WYOMING CONSOLIDATED OIL COM-  
PANY,**  
620 N. Marengo Ave., Pasadena, Cal.  
C. W. Leighton, President. A. L.  
Twombly, Secretary. July 18, 1912.  
\$3,000,000.

**YELLOW CREEK EXPLORATION COM-  
PANY,**  
Merchants National Bank Bldg., San  
Francisco, Cal. A. J. McNear, Presi-  
dent. W. F. Williamson, Secretary.  
November 22, 1917. \$25,000.

**\*YELLOWSTONE OIL COMPANY,**  
711 Merchants National Bank Bldg.,  
Los Angeles, Cal. J. H. Collier, Presi-  
dent. Ira L. Vance, Secretary. July  
10, 1907. \$1,000,000. Kern County.

**YORBA OIL COMPANY,**  
1004 Title Insurance Bldg., Los Angeles,  
Cal. C. L. Wallis, President. J. E.  
Wallis, Secretary. May 29, 1914.  
\$75,000.

**\*YORK COALINGA OIL COMPANY,**  
607 First National Bank Bldg., San  
Francisco, Cal. Robert Hays Smith,  
President. F. M. Bortner, Secretary.  
April 30, 1902. \$300,000. Fresno  
County.

**YOSEMITE OIL COMPANY,**  
414 Oakland Bank Bldg., Oakland, Cal.  
W. E. Beck, President. E. O. Hotch-  
kiss, Secretary. October 7, 1899.  
\$200,000, Orig.; \$10,000, Dec.

**\*ZENITH OIL COMPANY,**  
428-9 I. W. Hellman Bldg., Los Angeles,  
Cal. Edward Strasburg, President.  
A. F. Schiffman, Secretary. April 20,  
1900. \$30,000. One well, Los Angeles  
County.

**\*ZIER OIL COMPANY,**  
1002 Crocker Bldg., San Francisco, Cal.  
Wm. McQuire, President. C. H.  
Holbrook, Jr., Secretary. April 5,  
1905. \$100,000. Eighteen wells, Fresno  
County.

# APPENDIX.

## PUBLICATIONS OF THE CALIFORNIA STATE MINING BUREAU.

Publications of this Bureau will be sent on receipt of the requisite amount. Only stamps, coin or money orders will be accepted in payment.  
 Money orders should be made payable to the STATE MINING BUREAU.  
*Personal checks will not be accepted.*

### REPORTS.

Asterisk (\*) indicates the publication is out of print.

*Report	I.	Henry G. Hanks.	1880.		
*Report	II.	Henry G. Hanks.	1882.		
*Report	III.	Henry G. Hanks.	1883.		
*Report	IV.	Henry G. Hanks.	1884.		
*Report	V.	Henry G. Hanks.	1885.		
*Report	VI.	Part 1.	Henry G. Hanks.	1886.	
*Report	VI.	Part 2.	Wm. Ireland, Jr.	1886.	
*Report	VII.	Wm. Ireland, Jr.	1887.		
*Report	VIII.	Wm. Ireland, Jr.	1888.		
*Report	IX.	Wm. Ireland, Jr.	1889.		
*Report	X.	Wm. Ireland, Jr.	1890.		
Report	XI.	Wm. Ireland, Jr.	1892.	(First biennial)	Price \$1.00
*Report	XII.	J. J. Crawford.	1894.	(Second biennial)	-----
*Report	XIII.	J. J. Crawford.	1896.	(Third biennial)	-----
Chapters of State Mineralogist's Report, Biennial period, 1913-1914, Fletcher Hamilton:					
Mines and Mineral Resources of Imperial and San Diego Counties—F. J. H. Merrill. 1914					.35
Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties—W. B. Tucker. 1915					.50
Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma and Yolo Counties—Walter W. Bradley. 1915					.50
Mines and Mineral Resources, Del Norte, Humboldt and Mendocino Counties—F. L. Lowell. 1915					.25
Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties—Walter W. Bradley, G. C. Brown, F. L. Lowell and R. P. McLaughlin. 1915					.50
Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties—G. C. Brown. 1915					.50
Report XIV. Fletcher Hamilton, 1915, Biennial period 1913-1914. (The above county chapters combined in a single volume)					2.00
Chapters of State Mineralogist's Report, Biennial Period, 1915-1916, Fletcher Hamilton:					
Mines and Mineral Resources, Alpine, Inyo and Mono Counties, with geological map—Arthur S. Eakle, Emile Huguenin, R. P. McLaughlin, Clarence A. Waring. 1917					1.25
Same as above, without geological map					.65
Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter and Tehama Counties—W. Burling Tucker, Clarence A. Waring. 1917					.50
Mines and Mineral Resources, El Dorado, Placer, Sacramento and Yuba Counties—W. Burling Tucker, Clarence A. Waring. 1917					.65
Mines and Mineral Resources, Los Angeles, Orange and Riverside Counties—Frederick J. H. Merrill. 1917					.50
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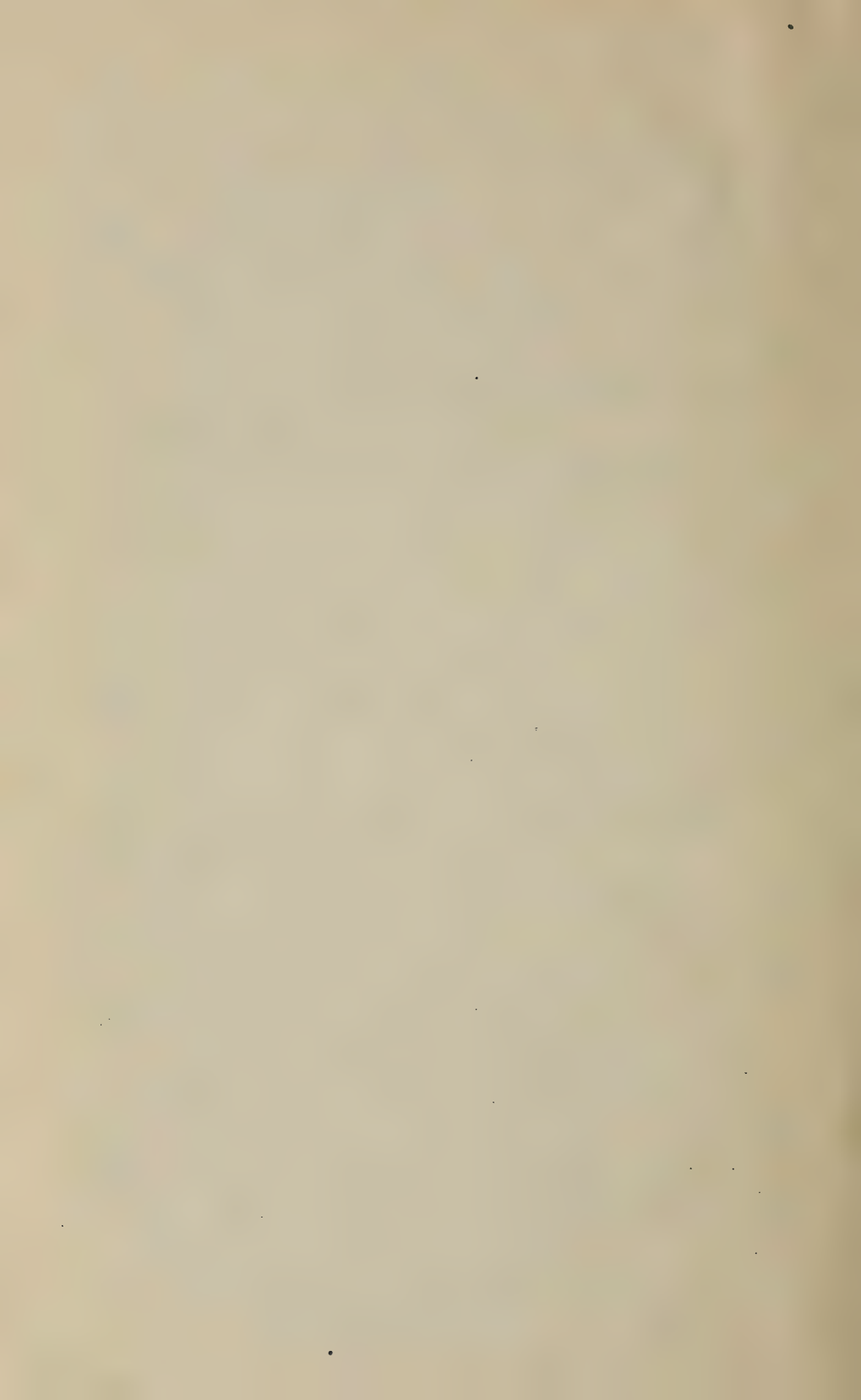
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